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THE NATIONAL GEOGRAPHIC MAGAZINE

MAY, 1920

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ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purpose for which it was founded thirty-two years ago, the National Geographic Society publishes this Magazine. All receipts from the publication are invested in the Magazine itself or expended directly to promote geographic knowledge and the study of geography. Articles or photographs from members of the Society, or other friends, are desired. For material that the Magazine can use, generous remuneration is made. Contributions should be accompanied by an addressed return envelope and postage, and be addressed: Editor, National Geographic Magazine, 16th and M Streets, Washington, D. C.

Important contributions to geographic science are constantly being made through expeditions financed by funds set aside from the Society's income. For example, immediately after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. So important was the completion of this work considered that four expeditions have followed and the extraordinary scientific data resultant given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures, evidently formed by nature as a huge safety-valve for erupting Katmai. By proclamation of the President of the United States, this area has been created a National Monument. The Society organized and supported a large party, which made a three-year study of Alaskan glacial fields, the most remarkable in existence. At an expense of over $50,000 it has sent a notable series of expeditions into Peru to investigate the traces of the Inca race. The discoveries of these expeditions form a large share of the world's knowledge of a civilization which was waning when Pizarro first set foot in Peru. Trained geologists were sent to Mt. Pelee, La Soufriere, and Messina following the eruptions and earthquakes. The Society also had the honor of subscribing a substantial sum to the historic expedition of Admiral Peary, who discovered the North Pole April 6, 1909. Not long ago the Society granted $20,000 to the Federal Government when the congressional appropriation for the purchase was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people and incorporated into a National Park.

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King Albert Buys a Hamilton Watch

IF you were a king, and wanted a watch—the best watch obtainable—how would you make your selection?

King Albert sought the advice of America's railroad men on his recent tour, asking their opinion as to the most accurate, most dependable watch. The answer, almost unanimously, was—"The Hamilton."

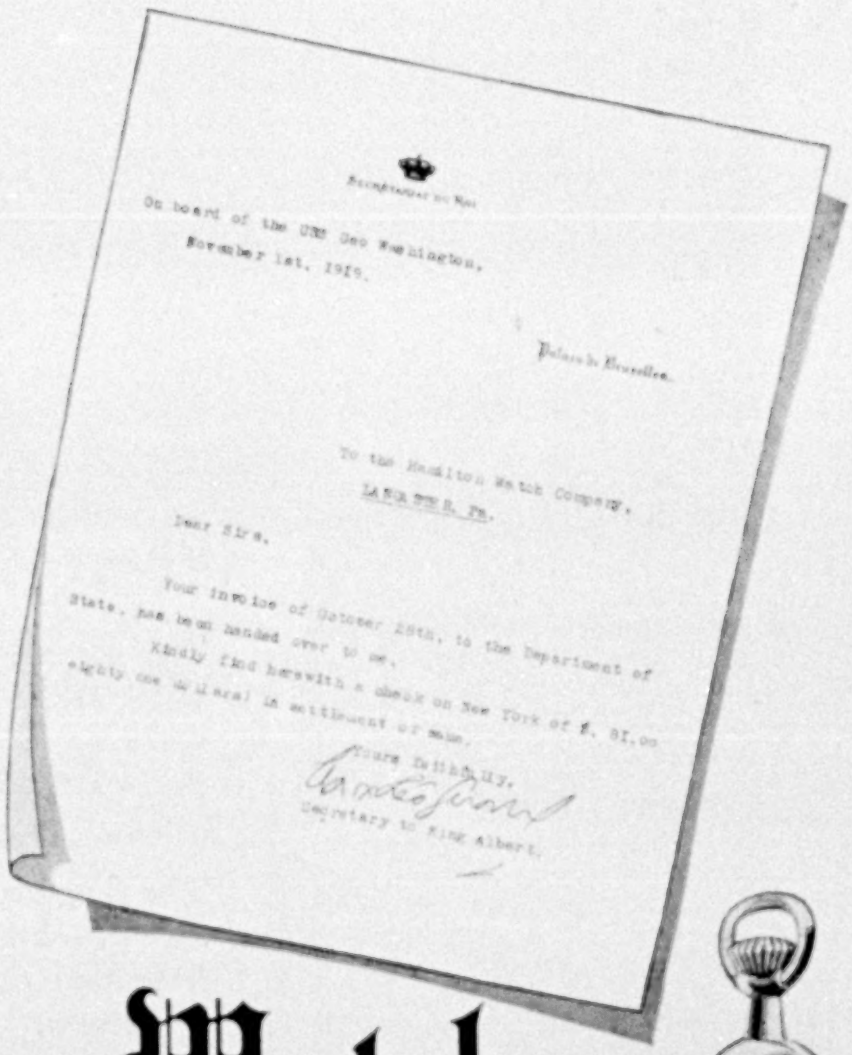
There's no better judge of watch worth, King Albert believes, than the American railroad man. So King Albert, able to pay many times the price, got a Hamilton.

Wouldn't the watch that is good enough for King Albert be a good watch for you to have? And wouldn't that sort of a watch make a splendidly appropriate gift for any occasion?

In the Hamilton line there's every kind of watch, from ladies' bracelet models to the sturdy railroad types—but they are *all* Hamiltons. Let your jeweler show you some of the many Hamilton models today. Prices from $38.00 to $200. Movements alone, $20.00 (in Canada $23.00) and up.

Send for "The Timekeeper." It's an interesting little booklet about the manufacture and care of fine watches. The various Hamilton models are shown and prices given.

HAMILTON WATCH COMPANY
Lancaster, Pa.


On board of the USS Geo Washington,
November 1st, 1919.

Palace de Bruxelles.

To the Hamilton Watch Company,
LANCASTER, Pa.

Dear Sirs,

Your invoice of October 28th, to the Department of State, has been handed over to me.

Kindly find herewith a check on New York of $. 81.00 eighty one dollars) in settlement or same.

Yours faithfully,
Secretary to King Albert.

Hamilton Watch

"The Railroad Timekeeper of America"

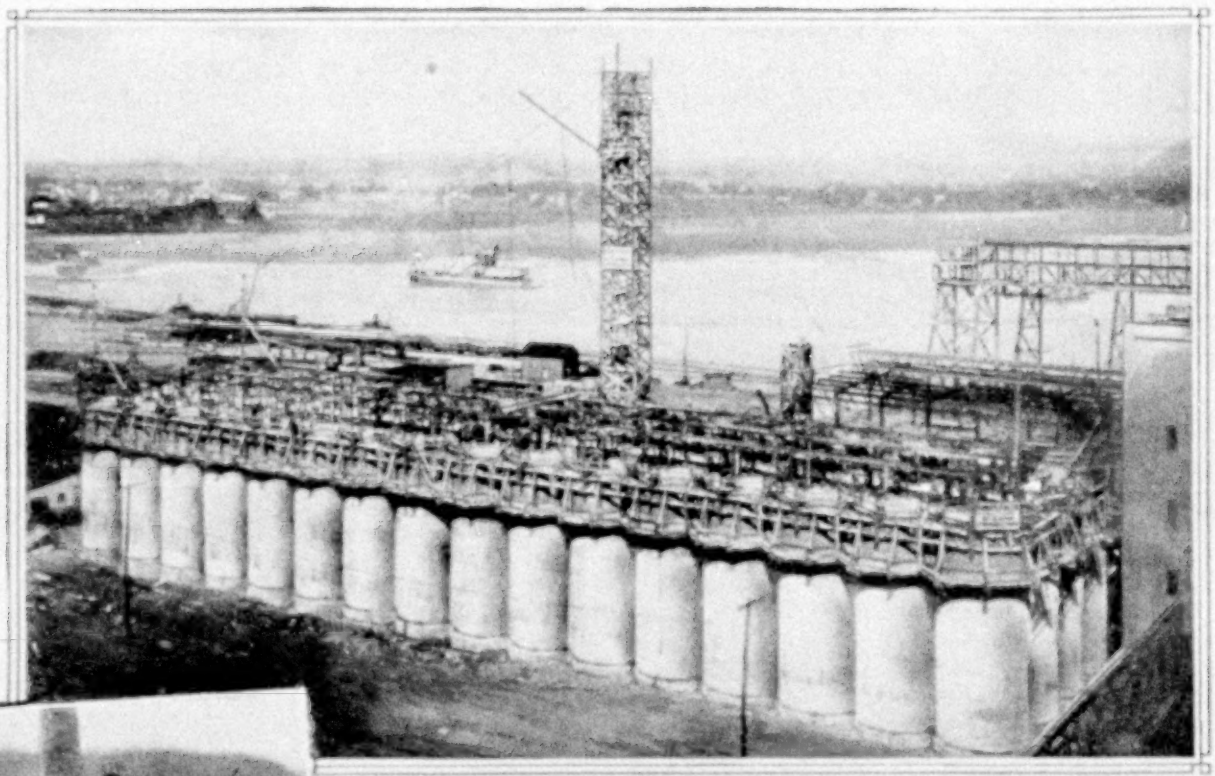
"The King of the Belgians ran his own locomotive for ten miles today. The special was stopped at Wauseon, Ohio, while His Majesty climbed into the engine cab and took the throttle from the regular pilot. The King has a thorough knowledge of locomotive engineering, and ran the heavy train for ten miles without a jolt."

Extract from New York Times, Oct. 8, 1919

King Albert in the Engine Cab of His Special

Fuller-Built Landmarks

1. Grain Elevators at Quebec, Canada.
   Harbour Commissioners Engineers.
2. W. Virginia Pulp & Paper Co. Plant Tyrone, Pa.
   F. G. Ten Broeck, Engineer.
3. Addition to Ford Motor Plant, Detroit, Mich.
   Albert Kahn, Architect.
   Ernest Wilby, Associate.
4. Kipawa Co. Pulp Paper & Sulphite Plant, Timiskaming, Canada.
   H. S. Ferguson Engineer.



When we build by the Acre

The covering of acres of country, with the many widely different types of structures that go to make up modern industrial plants is an important part of the building activity of the Fuller organization.

The four plants here shown cover a large total of acreage—but even more important, they give some indication of the vast diversity of our building operations.

The economy of building at any time lies in building right.

The Fuller Industrial Engineering Corporation supplements the building service of the George A. Fuller Company with expert engineering ability capable of handling the designing and equipping of industrial plants of all kinds with maximum speed and economy.

GEORGE A. FULLER COMPANY BUILDING AND INDUSTRIAL CONSTRUCTION

George A. Fuller Company

New York	New Orleans	Cleveland	St. Louis
Boston	Washington	Kansas City	Buffalo
Philadelphia	Baltimore	Chicago	*Shipyard*
Montreal	Pittsburgh	Detroit	Wilmington, N.C.

Thirty-nine Motor Cars in one City block. Traffic delays on every MAIN street and high road are largely due to the wide difference in performance ability among the cars that crowd it.

Who Makes the Best Time

AMERICA owned 6,300,000 passenger cars at the end of 1919. A quarter of a million in and around New York. Over a hundred thousand in Chicago. Philadelphia, Boston, St. Louis, San Francisco—every city has a like congestion.

With everybody depending on his car for *business* purposes, the faculty of ordinary cars for getting in one another's way becomes a serious matter—and the striking ability of the Packard to *run around and through traffic* is doubly worth thinking about.

THE Packard Company speaks with high authority when it says that *performance of the Packard kind* cannot be "assembled" into a car and cannot be "tuned" into it.

It is *fundamental* with the design and construction of the car.

The Packard Twin-six engine, with its steady flow of *flexible* power. Throttled down to two miles an hour on *high* in the jam, and picking up to thirty miles or more in half a block.

The Packard brakes—designed by Packard, with large, long wearing braking surfaces; equalized with even, positive braking action on each wheel; easily applied, sure to hold.

The Packard dry disc clutch, positive and velvety in action—and the Packard forged heat-treated gears, with their exceptional strength and long life.

The Packard steering gear and other parts controlling the car, quick and positive in action, easy to handle, tough and reliable.

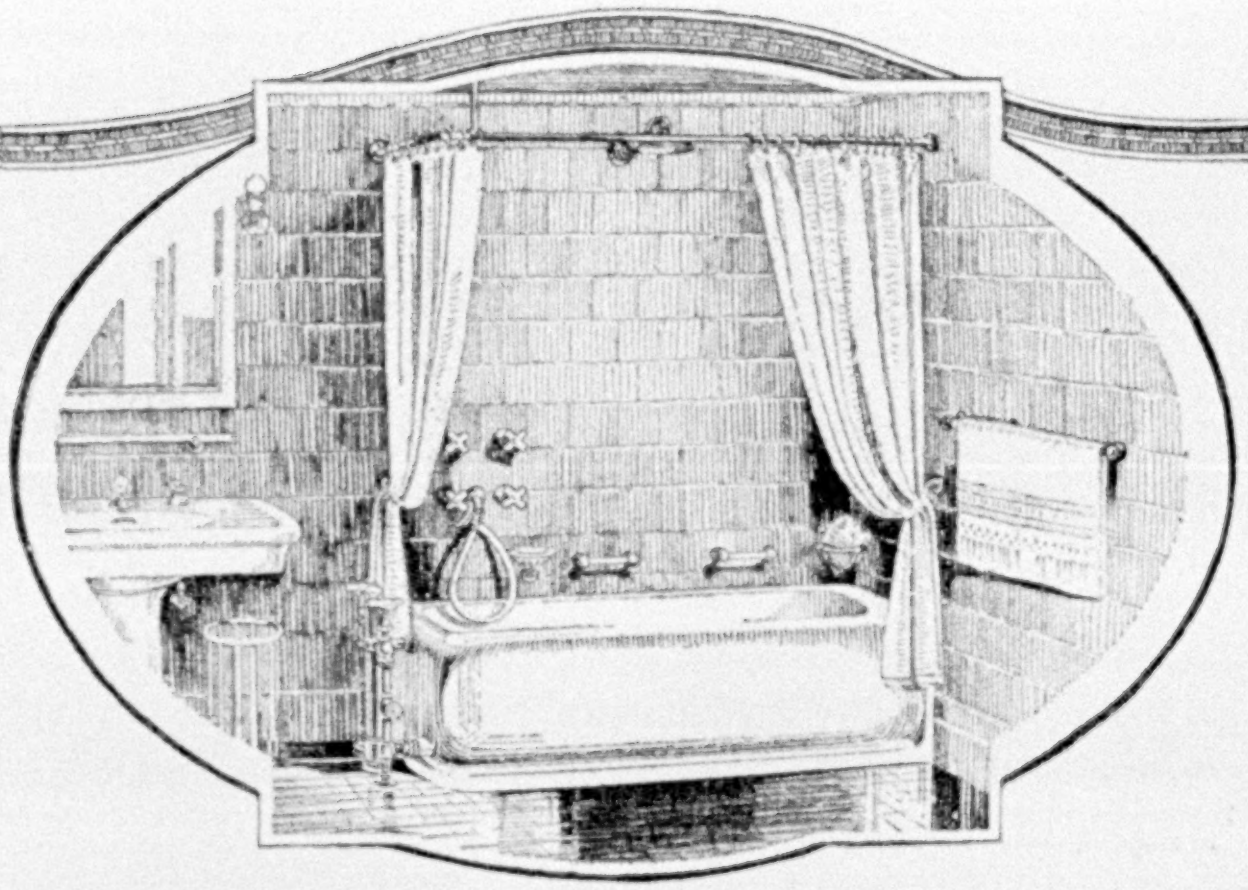
YOU often hear people say that they "get there so much quicker" in a Packard.

The Packard driver watches the *road* rather than the operation of his car.

He has less gear-shifting to do, less strain on his attention—and he can use the flexible power of his Packard to *advantage* every yard of the way.

"Ask the Man *Who Owns One"*

PACKARD MOTOR CAR COMPANY, *Detroit*



Quality Fittings for Every Building

Every building, small or large, should be planned for maximum comfort, convenience and durability, and this applies particularly to the plumbing, heating, ventilating and sanitary fixtures.

CRANE

high-quality products, backed up by Crane national service, make it possible to equip a small cottage or a great public building with equal assurance of detailed satisfaction, and with ample choice of types and design in each instance.

Experts in the numerous Crane exhibit rooms throughout the country are ready to give practical assistance in selecting the proper fixtures for any purpose. Call upon them.

Literature covering any desired CRANE PRODUCTS on request

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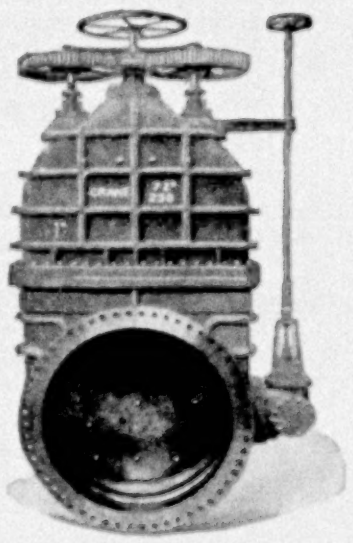


Crane
72-Inch Gate Valve

When it is considered that a man six feet tall could stand in the opening of this mammoth valve, a striking insight is gained into the scope of Crane manufacturing.

At Sleep-Time
Bubble Grains

Millions of happy children, at bedtime, get Puffed Wheat in milk. And think what a dish it is.

Whole wheat with no element omitted. Every food cell blasted, so digestion is easy and complete.

Wheat puffed to bubbles, eight times normal size—thin, flimsy, flaky morsels, like fairy foods.

Never was a whole grain made so enticing, never so fitted to digest. What good-night dish compares with this?

The supreme delights

Puffed Grains hold first place among all cereal dainties. Each is a food confection. The grains are so nut-like that people use them in home candy making—as garnish on ice cream.

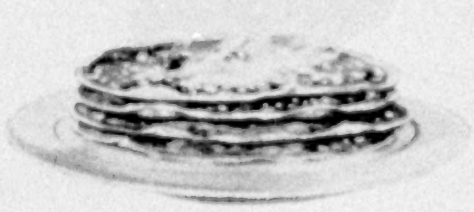
Yet two are whole grains, and all are scientific foods invented by Prof. Anderson.

Every food cell is blasted by a steam explosion. Every atom is fitted to digest.

When you have foods so delightful, so hygienic, serve in every way you can. Children revel in them.

Puffed Wheat Puffed Rice Corn Puffs

Also Puffed Rice Pancake Flour



For Nutty, Fluffy Pancakes

Now we make a pancake flour mixed with ground Puffed Rice. It makes nut-like, fluffy pancakes—the finest ever tasted. The flour is self-raising, so the batter is made in a moment. Try this new dainty. Ask for Puffed Rice Pancake Flour.

3351

A Diversity of Splendors

WHEN traveling this season, assure yourself of unalloyed enjoyment by converting your cash into

"A·B·A" American Bankers Association Cheques

the BEST funds for travelers

UNLIKE cash, A. B. A. Cheques are not almost a certain loss if lost or stolen for they cannot be cashed without your countersignature in the presence of the acceptor; they automatically identify the holder and are universally accepted by banks, hotels and tradespeople and transportation companies; they do not make the holder dependent upon banking hours; but they can be cashed whenever and wherever presented.

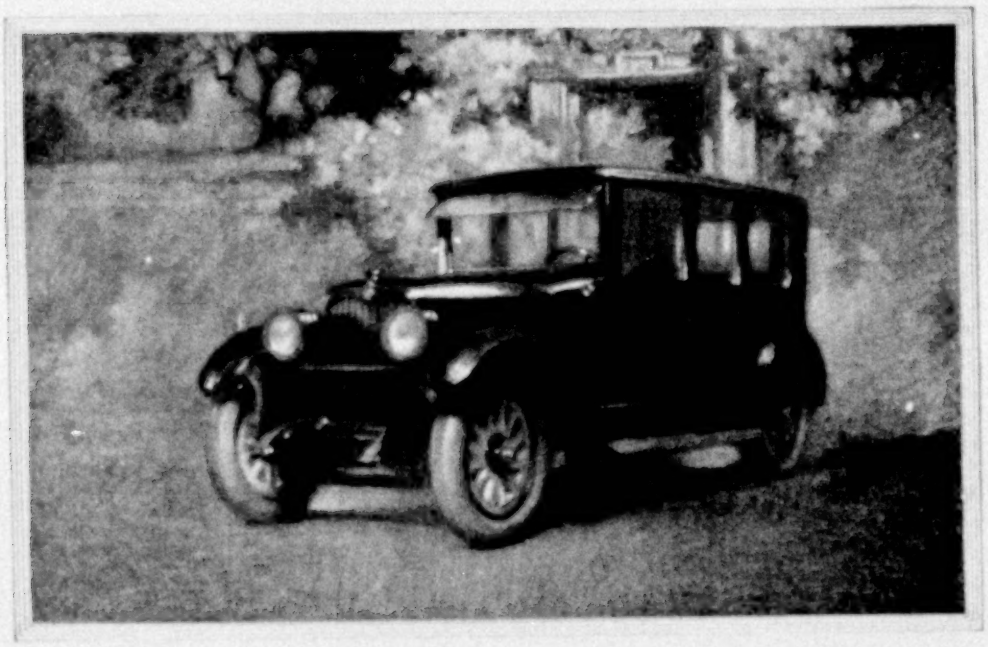
Issued by the American Bankers Association, consisting of 20,000 leading banks and sold in denominations of $10, $20, $50, $100.

Write for full information to

BANKERS TRUST COMPANY

New York City

IT IS not solely for quiet dignity or for graceful contour that LaFayette finds distinction in the eyes of its admirers.



Technically practiced minds, while not neglectful of these virtues, give even greater weight to its splendid engineering.

Impressively, this same concept likewise is widely shared by those who commonly find but scant interest in mechanical detail.

Some contend this to be the natural reaction of a public well informed on the previous works of the car's creators.

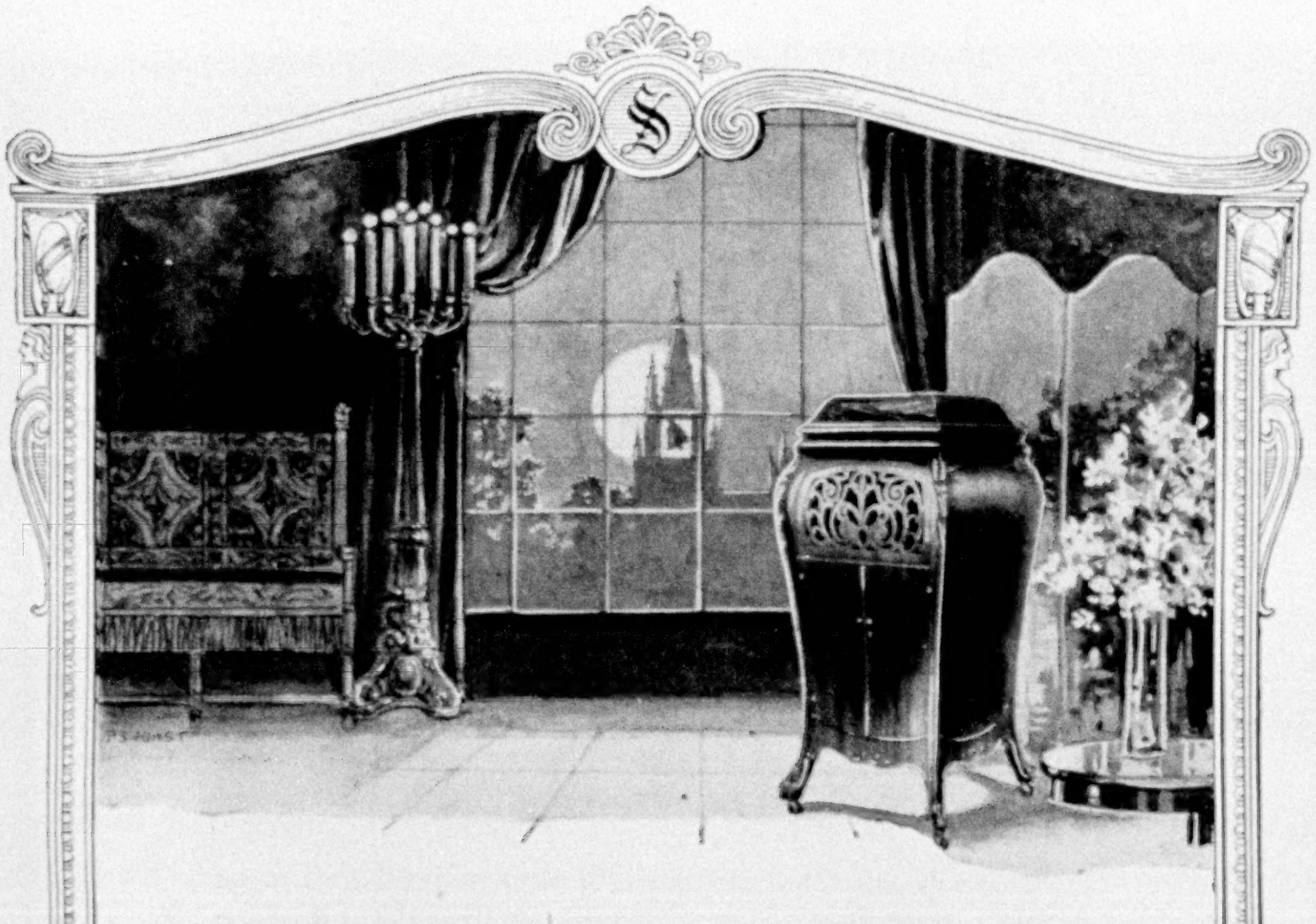
Others hold that the car itself conveys expert engineering so unmistakably as to impress even those who are not technically inclined.

The fact is, that in this, as in every component of LaFayette, its creators have essayed the literal expression of their ideal motor car.

LAFAYETTE MOTORS COMPANY at *Mars Hill* INDIANAPOLIS

LAFAYETTE

"Mention The Geographic—It identifies you"



A TONE as brilliant as the sparkle of gems and as sweet as an old love song—as clear as the Sabbath church bells' chimes and as true as the ring of a gong—this is Sonora's tone which was awarded the highest score at the Panama Pacific Exposition.

THE INSTRUMENT OF QUALITY

Sonora

CLEAR AS A BELL

is made for those to whom *quality* is the leading attraction. When you purchase a Sonora you have the pride of possessing an instrument of matchless beauty, recognized by all as being the Highest Class Talking Machine in the World.

Magnificent Upright and Period Models $60 to $2500

Special models will be made to order. We are also prepared to place Sonora equipments in treasured cabinets which you may now own.

Write for General Catalog 37 or Period Catalog 37X

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GEORGE E. BRIGHTSON, President

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Canadian Distributors: I. Montagnes & Co., Toronto

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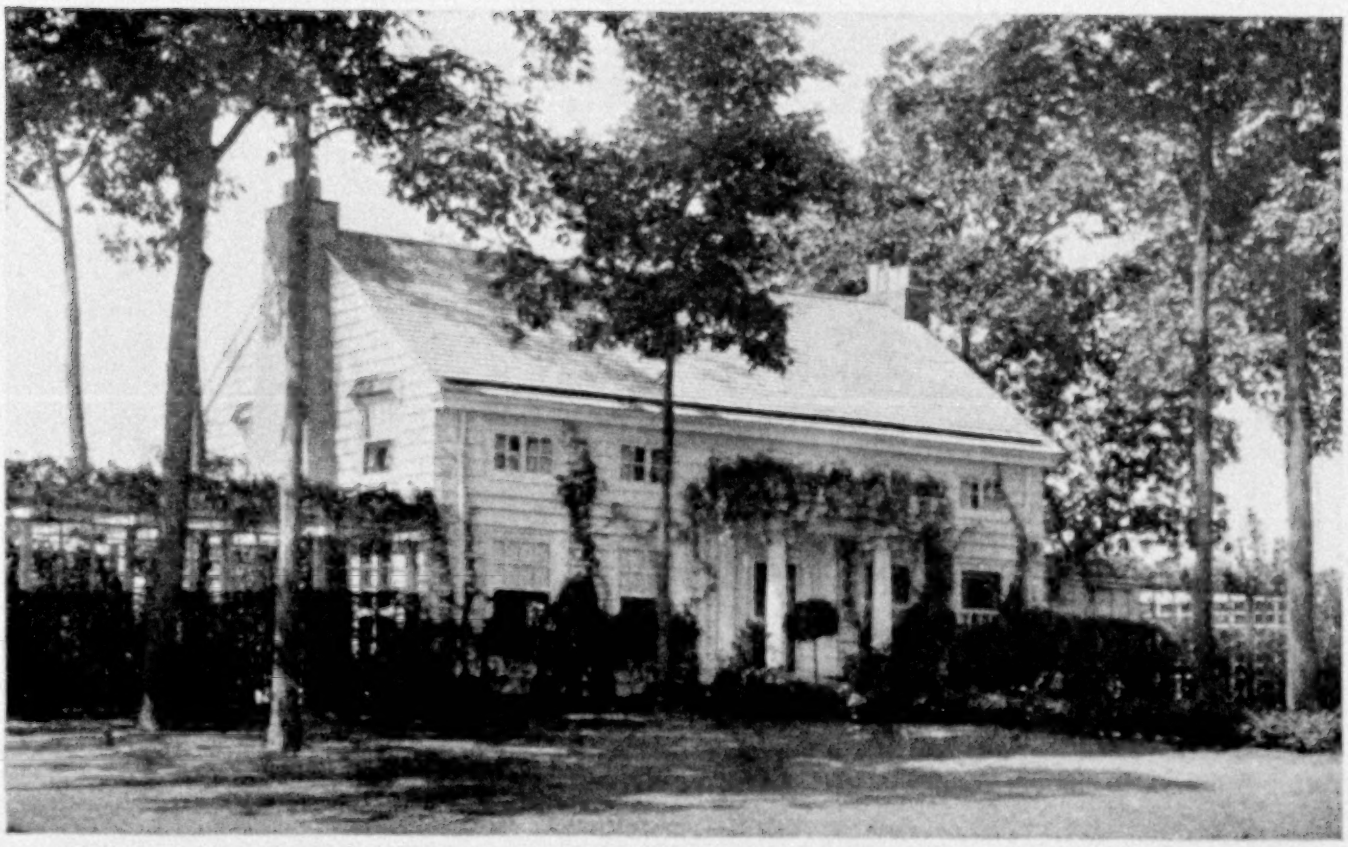
Use Sonora Semi-Permanent Needles on all steel needle lateral cut records. They sweeten the tone, play many times, do away with inconvenience of frequent needle-changing, and increase the records' life.



House of Mr. Chauncey Olcott, Saratoga N. Y. Charles Barton Keene, Architect, Philadelphia.

FITNESS for the particular use to which they are to be put should be your guide in selecting the woods for your home.

Almost any wood will prove satisfactory on the inside of the house; but this is not true on the outside, where the wood is exposed to heat and cold, sun and wind, rain and snow.

That's why it is important for you to get the right wood on the outside. The wood you use there will determine your repair charges and the appearance of your house—both vital matters.

WHITE PINE

The many old houses in all parts of the country—in New England dating back to early Colonial times—attest the durability of White Pine.

It does more than just last. It holds its place perfectly without warping, splitting, rotting or opening at the joints, even in the most delicate mouldings and carvings.

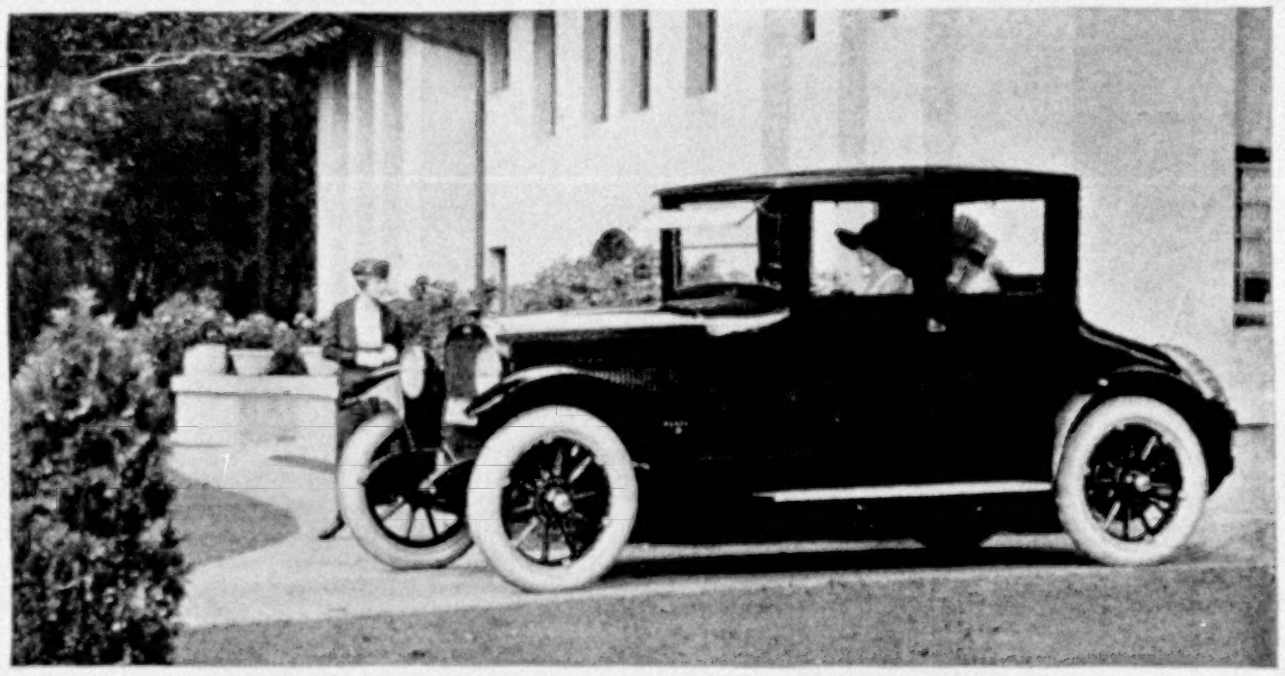
That is why it has always been the preferred wood in this country—why it is the most economical.

WHITE PINE BUREAU,
1506 Merchants Bank Building, St. Paul, Minn.

"White Pine in Home Building" is beautifully illustrated with old Colonial and Modern homes, full of valuable information and suggestions on home-building, and gives a short, concise statement of the merits of White Pine. Send for it now. There is no charge for it to prospective home-builders.

CHANDLER SIX

Famous For Its Marvelous Motor



Why So Many Prefer the Chandler Six

THE appeal of the handsome Chandler Sedan and Coupe is far-reaching among men and women who are appreciative of the better qualities of motor car design and construction and finish.

The beauty of line and snug comfort and fine upholstering and finish naturally appeal to them in a great degree. But they all appreciate quite as much the ease of driving the Chandler Six, the unusual flexibility of the power of its marvelous motor, simplifying control of the car in traffic and adding no end of pleasure to open-road driving.

The Chandler Coupe seats three persons in luxurious comfort, or four when the large deep-cushioned auxiliary seat is used. The Sedan, quite the most attractive of sedans, seats seven persons in perfect comfort or five without the use of the folding spring-cushioned chair seats.

The Chandler car, in all models, is more fairly priced than any other car of similar quality

SIX BEAUTIFUL TYPES OF BODY

Seven-Passenger Touring Car, $1895 *Four-Passenger Roadster, $1895*

Four-Passenger Dispatch Car, $1975

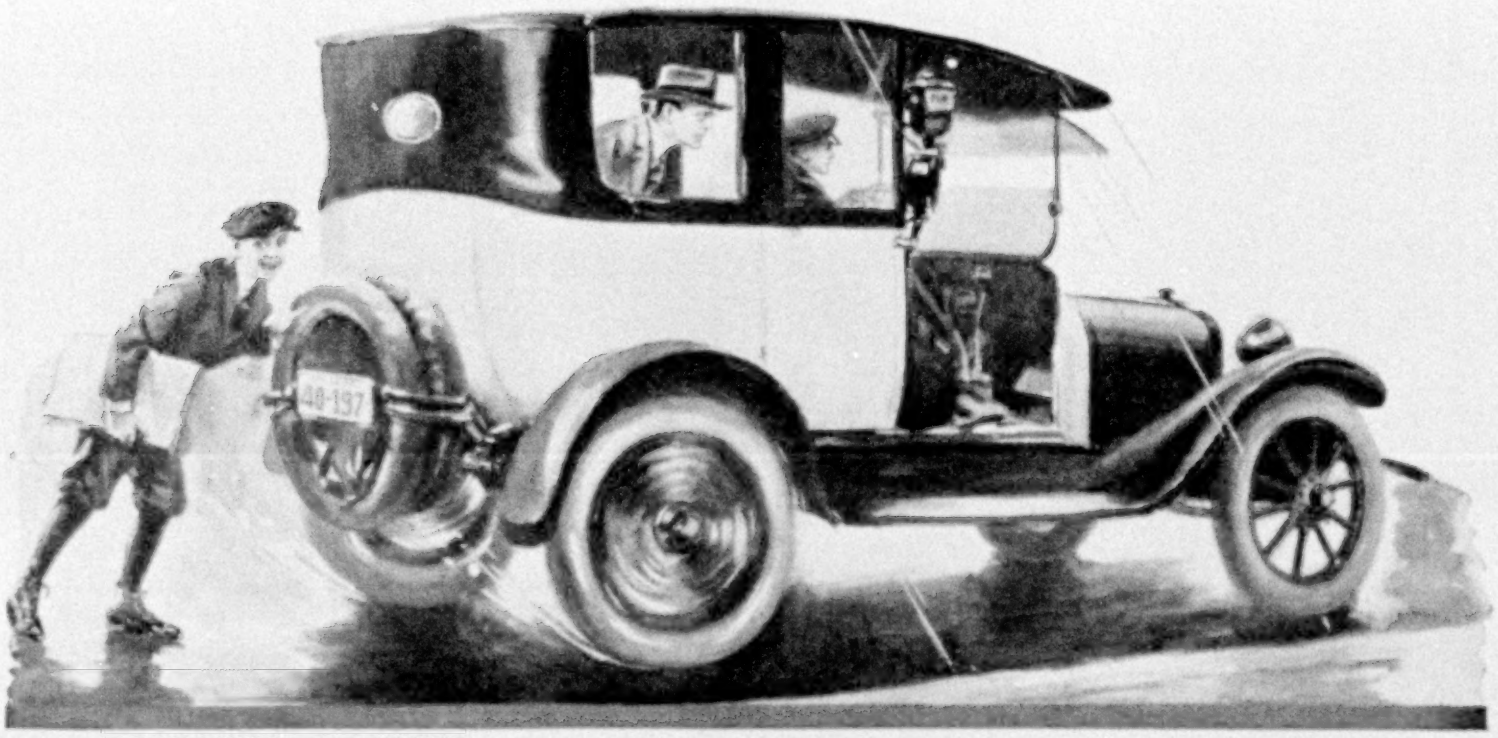
Seven-Passenger Sedan, $2895 *Four-Passenger Coupe, $2795* *Limousine, $3395*

(All prices f. o. b. Cleveland, Ohio)

Dealers in all Principal Cities and Hundreds of Towns

CHANDLER MOTOR CAR COMPANY, CLEVELAND, O.

Export Department: 5 Columbus Circle, New York Cable Address: "CHANMOTOR"



Plenty of Power but no Traction—spinning wheels that get nowhere

—and the man in the taxi believes he is paying for the futile spinning of the wheels. The meter on his car back home would register them in miles.

He believes the taximeter is registering a charge against him for the useless spinning of the rear wheels and the resulting damage to the tires.

A valuable object lesson, if it makes him think of his own car and how he abuses his own tires when he fails to put on

Weed Tire Chains

For Sure and Certain Traction

The taxicab companies protect the Public and themselves from skidding accidents—from excessive costs. *Taxicab wheels spin only when drivers disobey the companies' order to "Put on Tire Chains when streets are wet or slippery."* And to safeguard their patrons against the drivers' possible negligence, the taximeter is attached to *front* wheels.

Weed Tire Chains, when used judiciously, *lengthen the life of tires.* Whether they are used on taxicabs or on pleasure cars, Weed Tire Chains materially *reduce operating expenses.*

Nothing looks more ridiculous than a spinning tire—nothing more brainlessly extravagant. Put on Weed Tire Chains "at the first drop of rain."

AMERICAN CHAIN COMPANY, Inc.

BRIDGEPORT CONNECTICUT

In Canada: Dominion Chain Company, Limited, Niagara Falls, Ontario

Largest Chain Manufacturers in the World

The Complete Chain Line—All Types, All Sizes, All Finishes—From Plumbers' Safety Chain to Ships' Anchor Chain.

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Books That Enrich Every Spring Ramble

The Book of Birds

Text by Henry W. Henshaw, George Shiras, 3rd, F. H. Kennard, and Wells W. Cooke

250 bird portraits in natural color, by Louis Agassiz Fuertes

This beautiful work adds an airy level to life by enabling one to identify, attract, photograph, or make true friends of one's feathered neighbors of dooryard and woodland.

It lets us share the winged spring courtships, home makings and the training of nestlings—it is the libretto of the bird opera.

Answers the question, "What Bird is That?" for adult, for teacher, or for little child

Buckram or flexible khaki, postpaid in U. S., $3.00

The Book of Dogs

Text by Harold Baynes
America's Foremost Authority

128 dog portraits in full color by Louis Agassiz Fuertes

Dog lovers are charmed by its tribute to dog devotion, sagacity, heroism and military service.

Fanciers find its descriptions and pictures of breed and type authoritative.

Nowhere else do children find more lovely pictures of dogs, tiny, big, wise and brave.

Needed by all who would choose dog playmate or guardian by character rather than looks

Buckram or flexible khaki, postpaid in U. S., $2.00

Wild Animals of North America

127 paintings in full color — **Many half-tones and track sketches**

There are wild animals in your own yard and trees and in the nearby parks, as well as in forest and mountain. From tiny field mouse or mole or chipmunk to elk, treacherous wild cat or bear or seal, this "Who's Who" of the Animals gives their fascinating histories and, in most cases, their pictures in full natural color. With this book you can identify scurrying bit of fur or strange track in garden or in imagination hunt big game in the Rockies or Alaska. To the children it is an inexhaustible story-telling Noah's Ark. In the school-room, scout groups, or summer camp, it is invaluable to teacher and leader.

Through the magic pen of Edward W. Nelson, Chief, U. S. Biological Survey, these animals are made actively to live for us. We learn their personalities and why they act as they do. For Mr. Nelson has brought to this peerless book not merely deep scientific attainment, but also a deep love for all four-footed creatures, born of over forty years' friendly intimate association with them. Louis Agassiz Fuertes, Master Painter of Beast and Bird, also has preserved not merely form and color, but the very character of his subjects. Ernest Thompson Seton, by track sketches, helps us to read the "paw print Bertillon" on snow or earth.

Buckram or flexible khaki, postpaid in U. S. $3.00

CUT ON THIS LINE

Dept. H, National Geographic Society,
Washington, D. C.:

.....1920

Please send.....copies THE BOOK OF DOGS; .....copies THE BOOK OF BIRDS; .....copies WILD ANIMALS OF NORTH AMERICA.

Enclosed.....Dollars.

NAME..... ADDRESS.....

(5-20)

Obtainable only from the Society's Headquarters

Reproduction of a painting in oil of the beautiful estate of Thomas A. Edison, West Orange, New Jersey

Among prominent persons served by Davey Tree Surgeons are:

MRS. L. C. LEDYARD
ROBERT T. LINCOLN
SEAVIEW GOLF CLUB
HON. JAMES COUZENS
HON. EDWIN T. MEREDITH
EDGAR F. LUCKENBACH
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JOHN DAVEY
Father of Tree Surgery

SUCCESSFUL treatment of tree troubles begins with the diagnosis. Unless the ailment is located and understood it cannot be corrected. Long experience and training have given Davey Tree Surgeons a skill and a sureness in this work that is remarkable. Collaborating with them is the Davey Research Bureau—a laboratory in charge of real tree scientists. This bureau seeks to solve every tree problem, new or old, and give scientific proof for every process of Davey Tree Surgery.

A sick tree and a sound, healthy tree often look practically alike to the untrained eye. The leaves may be green and luxuriant and yet the tree be rotting away within. The trunk may appear perfect and yet the tree be suffering from disease or injury or insect attacks of various kinds. Any of these ailments neglected very often mean premature death.

If you have any tree problem on which you want help, you are invited to correspond with the Davey Research Bureau.

One or more of your most important trees may, unknown to you, be afflicted by one trouble or another and steadily going from bad to worse. The next storm may leave them wrecks. Your fine old trees are priceless. Once lost, they cannot be replaced in your lifetime. Learn their real condition and needs now. Don't wait until irreparable damage has been done. A careful examination made by appointment.

THE DAVEY TREE EXPERT CO., Inc., 1505 Elm St., Kent, Ohio

Branch Offices with telephone connections: New York City, Astor Court Bldg.; Chicago, Westminster Bldg.; Philadelphia, Land Title Bldg., and Boston. Write nearest office

Permanent representatives available in districts surrounding Boston, Springfield, Lenox, Newport, Hartford, Stamford, Albany, Poughkeepsie, White Plains, Jamaica, Montclair, New York, Philadelphia, Harrisburg, Baltimore, Washington, Richmond, Buffalo, Toronto, Pittsburgh, Cleveland, Detroit, Cincinnati, Chicago, Milwaukee, and St. Louis. Canadian address: 252 Laugauchitere West, Montreal

DAVEY TREE SURGEONS

Every real Davey Tree Surgeon is in the employ of The Davey Tree Expert Co., Inc., and the public is cautioned against those falsely representing themselves. An agreement made with the Davey Company and not with an individual is certain evidence of genuineness

"Mention The Geographic—It identifies you"

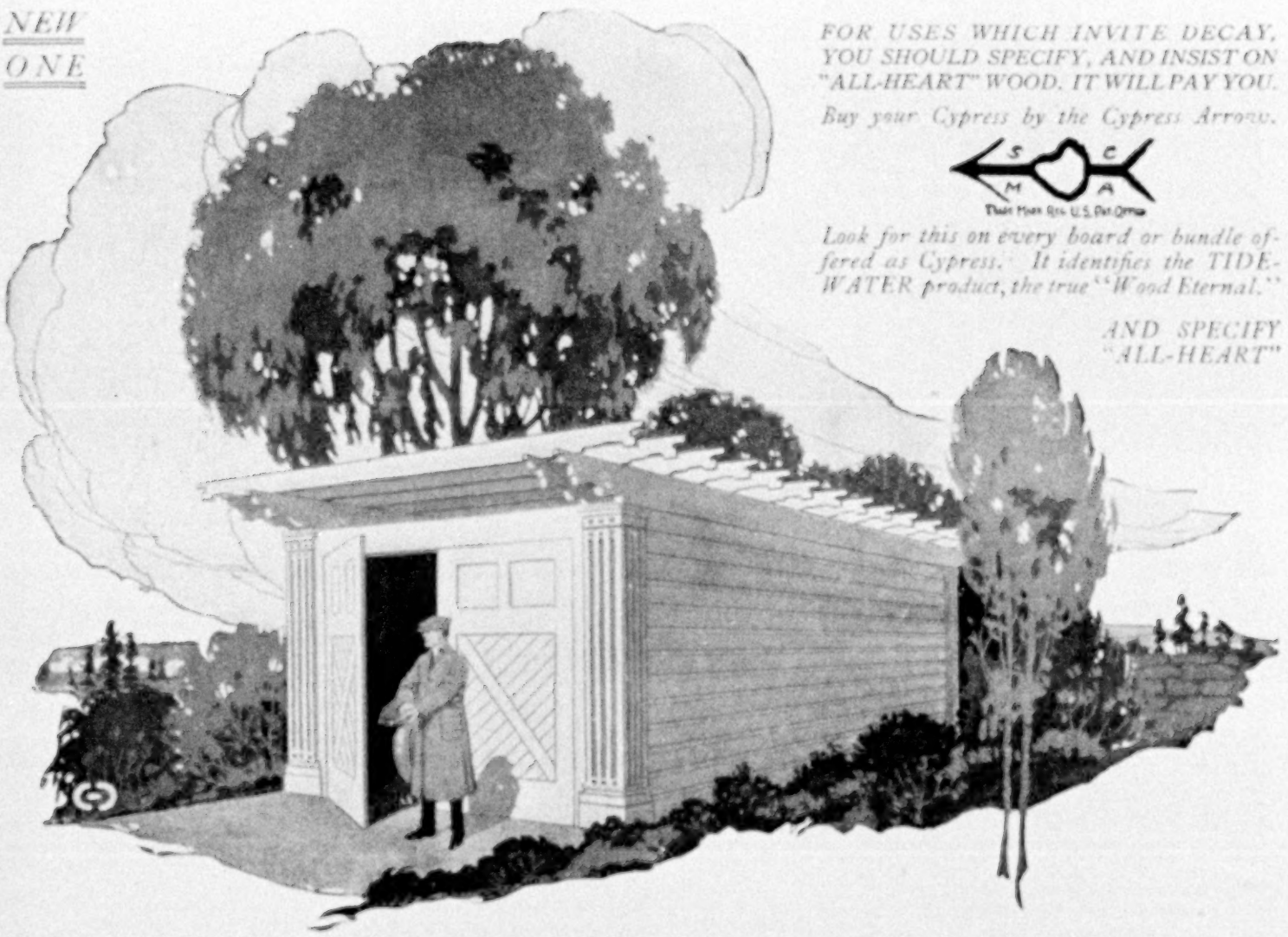
NEW ONE

FOR USES WHICH INVITE DECAY, YOU SHOULD SPECIFY, AND INSIST ON "ALL-HEART" WOOD. IT WILL PAY YOU.

Buy your Cypress by the Cypress Arrow.

Look for this on every board or bundle offered as Cypress. It identifies the TIDE-WATER product, the true "Wood Eternal."

AND SPECIFY "ALL-HEART"



The Cypress "Pergola-Garage"

Why should a garage be homely? This one isn't.—(Is it?)

The man in front is the owner. He looks well satisfied with the fact that he has enhanced the beauty of his grounds at the same time that he has protected his car.

The picture shows how *your* garage may look if you will allow us to send you, with our compliments, and with no obligation at all, the

Complete Working Drawings (on sheet 24 x 36 inches)

including full specifications—enough for any good carpenter to build from. Perhaps you enjoy such work yourself. If so, you can't go wrong.

It might even be possible to remodel your present garage on these lines. If you do so, of course you will know what kind of lumber to buy. "If you build of Cypress you build but once." You know "the Wood Eternal" is the champion pergola lumber—does not tend to shrink, swell or warp like so many woods—takes paint and stain beautifully, but *does not need either*, except for looks—lasts and lasts and lasts and lasts without them. (See U. S. Govt. Rept., reprinted in full in Vol. 1, Cypress Pocket Library. Just mention that you'd like this book, also.)

This Pergola-Garage is AN ADDED SUPPLEMENT

to the 9th big reprint of VOLUME 28 of that home-lovers' guide, counselor and impartial friend, the famous Cypress Pocket Library. It's FREE. Will you write?

When planning a Pergola, Mansion, Bungalow, pasture-fence or sleeping porch, remember, "*With CYPRESS you BUILD BUT ONCE*"

CYPRESS DEFIES DECAY

Let our "ALL-ROUND HELPS DEPARTMENT" help YOU *MORE*. Our entire resources are at your service with Reliable Counsel.

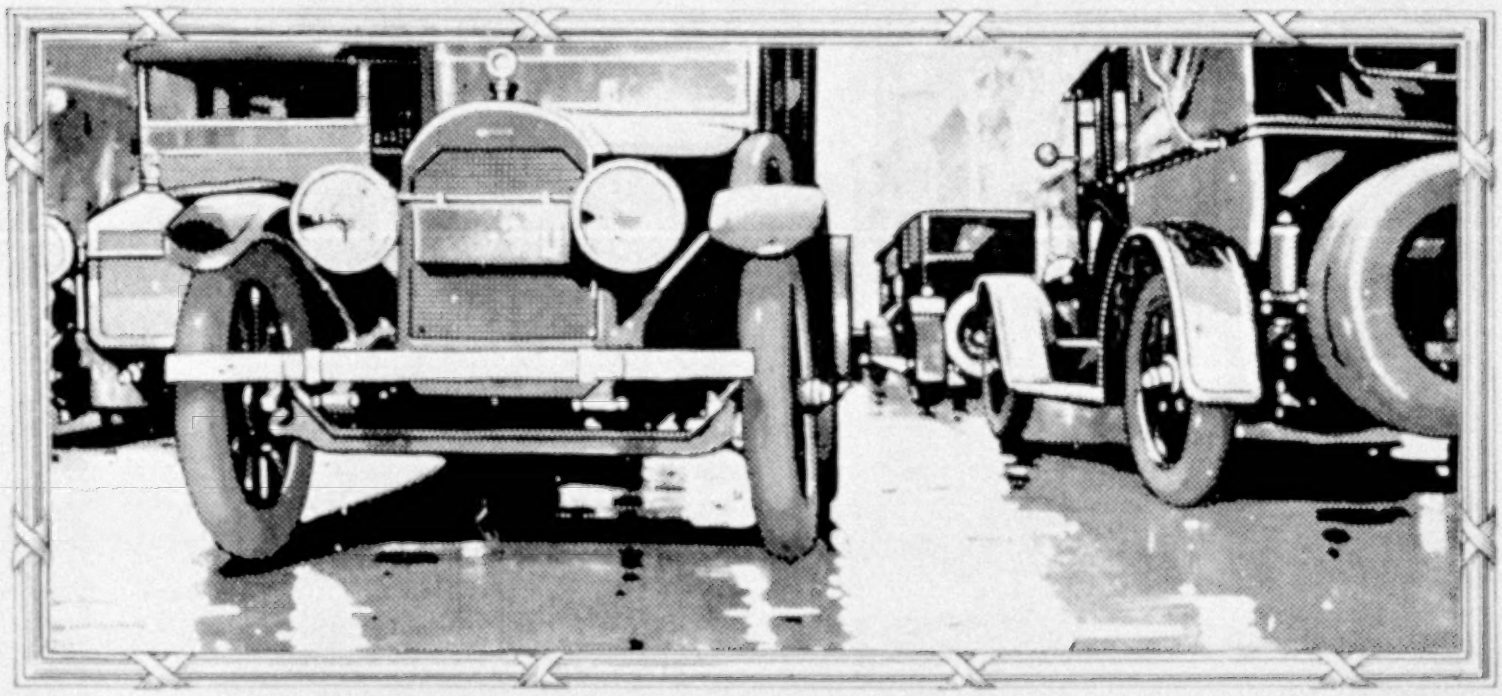
SOUTHERN CYPRESS MANUFACTURERS' ASS'N.

1224 Hibernia Bank Building, New Orleans, La., or 1224 Heard National Bank Building, Jacksonville, Fla.

CYPRESS AVERTS REPAIR BILLS

INSIST ON TRADE-MARKED CYPRESS AT YOUR LOCAL LUMBER DEALER'S. IF HE HASN'T IT, *LET US KNOW IMMEDIATELY*

You never get more out of your Tire than the Maker put in



The car in the foreground has a wheel out of line.

Few motorists realize that a displacement of only one degree has the same effect on a tire as if it was dragged 92½ feet in every mile.

STAND on a street corner some day and watch the motor cars go by. Every now and then you will see a motorist with two or three tires strapped on the back of his car, each tire of a different make.

A man afraid of his tires.

* * *

No matter how many precautions a man may take he will never get out of a tire *more* than the maker put into it.

If a tire is built to go a *limited number of miles* there is no reason why it should be expected to go any farther.

When it breaks down before it has gone the limit, there is no reason why an allowance should not be made to the buyer.

What intelligent buyers are looking for is *better tires*—not limited-mileage tires or conciliatory allowances.

And they are beginning to look behind tires to the *principles* on which they are built and sold.

* * *

Here is the principle which governs the production and sale of U. S. Tires: Build a tire as good as human skill can build it, and let *responsibility for quality* exceed every other consideration.

Seek out the new kind of tire dealer—the man who believes in quality and square dealing, who is putting the tire business on as sound a basis as any other retail business in his town.

Back of him stands every resource and facility of the United States Rubber Company—the oldest and largest rubber organization in the world.

U. S. Tires are built on a *quality* basis as fast as quality conditions will permit—*and no faster.*

And they are guaranteed free from defects in materials and workmanship for the life of the tire—*with no limitation of mileage.*

United States Tires

United States Rubber Company

Fifty-three Factories — *The oldest and largest Rubber Organization in the World* — *Two hundred and Thirty-five Branches*

"Mention The Geographic—It identifies you"

SANFORD'S
Library Paste
Sticks Instantly
Goes Farthest

The Water-well Jar
Keeps Both Brush
and Paste in Perfect
Condition

General Motors Trucks

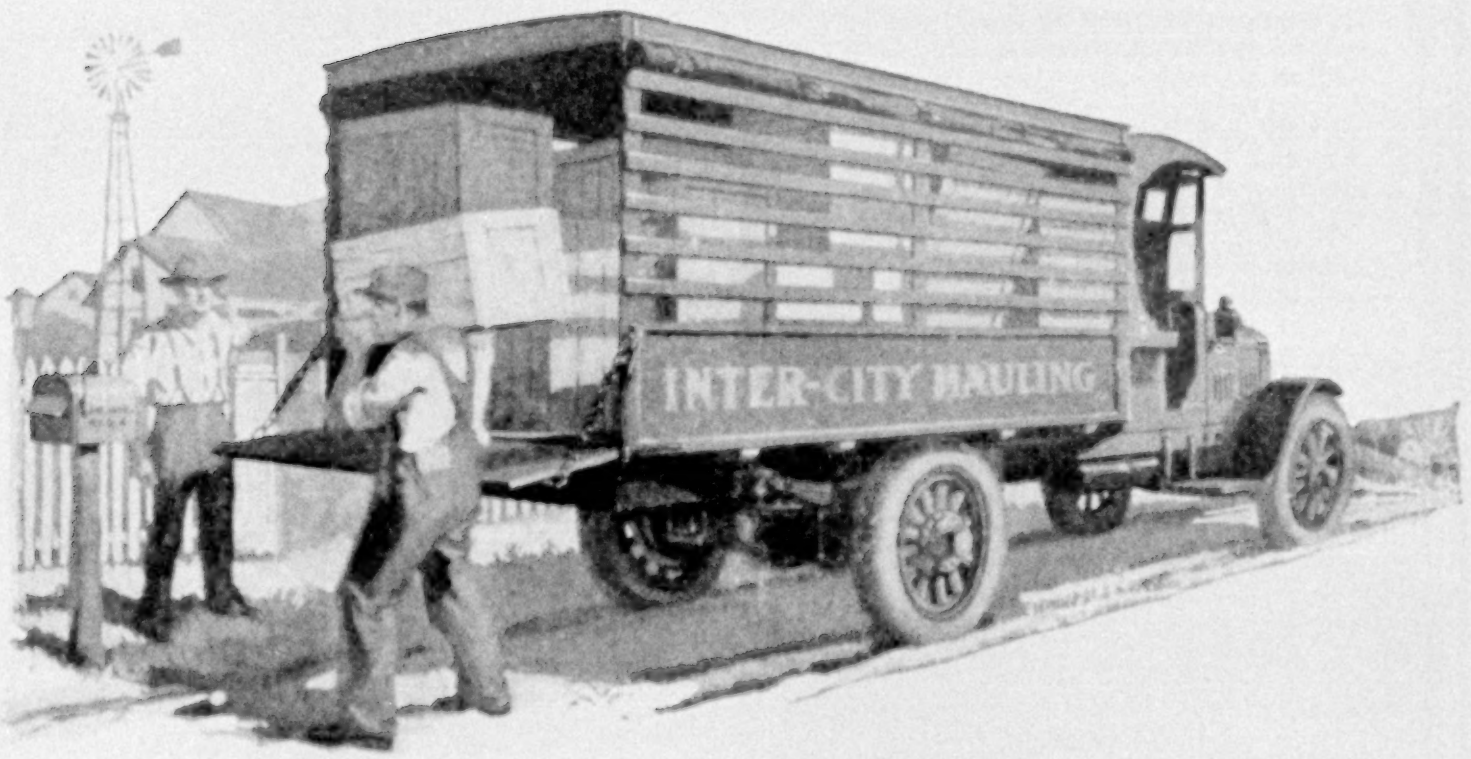
IN building GMC trucks, the fundamental idea has been to so construct them that they will do their tasks without faltering. GMC trucks not only possess maximum pulling power, but they also have the strength and stability to bear, successfully, loads up to the limit of their pulling capacity.

GENERAL MOTORS TRUCK COMPANY

One of the Units of the General Motors Corporation

PONTIAC, MICH.

(634)



"Mention The Geographic—It identifies you"

"AMERICA'S FINEST CABINET WOOD"

RED GUM

You can hardly look through a high class magazine of general circulation today without finding from one to half a dozen attractive advertising pages designed to interest the building owner or home builder in the advantages—practical as well as artistic—of some particular species of wood.

The more you study the subject of wood values, the more fascinating the subject becomes, and this is as it should be, for you live intimately with your doors, trim and panelling, and if these are chosen with taste and discrimination they are a constant joy.

The first wood which was advertised to the general public was

RED GUM

and the public has responded most understandingly. There are scores of America's finest hotels and literally hundreds of office buildings, apartment houses and charming private residences in which the doors, trim and panelling are made of RED GUM ("AMERICA'S FINEST CABINET WOOD").

When you are looking into the subject of wood, as you must sooner or later, address Red Gum Division,

AMERICAN HARDWOOD MANUFACTURERS' ASSOCIATION

1311 Bank of Commerce Building MEMPHIS, TENN.

and ask them to send you interesting RED GUM booklets and graphic RED GUM samples. There is no charge for them (even though they are worth quite a lot of money).

HARRISON MEMORIALS

A memorial of enduring granite can be an appropriate expression of one's individuality.

It need not be elaborate. A classic block of Barre granite—or a dignified shaft—may be the truest interpretation.

We offer you 74 years of artistic and structural success as a guarantee of our ability to serve you intelligently.

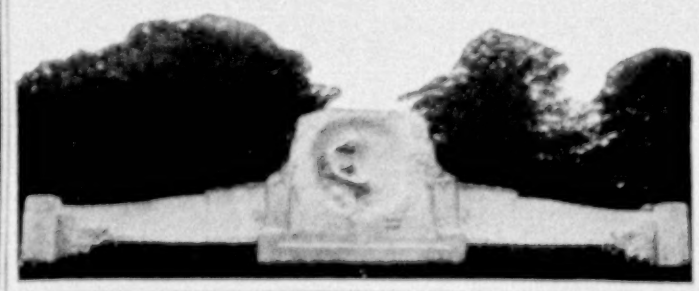
Send for Booklet No. 3

HARRISON GRANITE COMPANY

200 Fifth Ave., New York

Offices in principal cities Works: Barre, Vt.

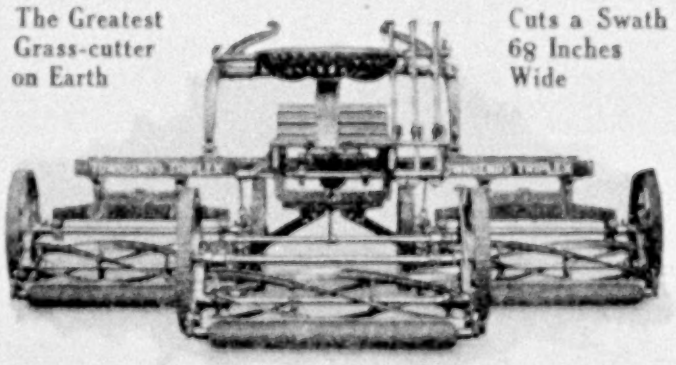
Member of Memorial Crafts Institute



TOWNSEND'S TRIPLEX

The Greatest Grass-cutter on Earth

Cuts a Swath 68 Inches Wide



Floats Over the Uneven Ground as a Ship Rides the Waves

One mower may be climbing a knoll, the second skimming a level, while the third pares a hollow. Drawn by one horse and operated by one man, the TRIPLEX will mow more lawn in a day than the best motor mower ever made; cut it better and at a fraction of the cost.

Drawn by one horse and operated by one man, it will mow more lawn in a day than any three ordinary horse-drawn mowers with three horses and three men.

Does not smash the grass to earth and plaster it in the mud in springtime, neither does it crush the life out of the grass between hot rollers and hard, hot ground in summer, as does the motor mower.

The public is warned not to purchase mowers infringing the Townsend Patent, No. 1,209,519, December 19th, 1916.

Write for catalog illustrating all types of Lawn Mowers.

S. P. TOWNSEND & CO.

27 Central Avenue Orange, New Jersey

The Thief of Beauty

"HOW to stay Time in its relentless course?" That is the problem of Beauty. How to keep the lips young, the throat round and firm, the skin smooth and free from the lines that mark the progress of the years.

Does Beauty know that Pyorrhea is an enemy—as well as Time? Does Beauty know that Pyorrhea wrecks the health and brings the brand of age? Pyorrhea is a disease of the gums that begins with tenderness and bleeding. Then the gums recede, the lips lose their youthful contour, the teeth decay, loosen and fall out, or must be extracted to rid the system of the infecting Pyorrhea germs that cause so many ills.

Four out of five people over forty have Pyorrhea. You can keep this insidious disease away. Visit your dentist frequently for tooth and gum inspection—and use Forhan's For the Gums.

Forhan's For the Gums will prevent Pyorrhea—or check its progress—if used in time and used consistently. Ordinary dentifrices cannot do this. Forhan's keeps the gums firm and healthy—the teeth white and clean.

How to Use Forhan's

Use it twice daily, year in and year out. Wet your brush in cold water, place a half-inch of the refreshing, healing paste on it, then brush your teeth *up and down*. Use a rolling motion to clean the crevices. Brush the grinding and back surfaces of the teeth. Massage your gums with your Forhan-coated brush—gently at first until the gums harden, then more vigorously. If the gums are very tender, massage with the finger, instead of the brush. If gum-shrinkage has already set in, use Forhan's according to directions and consult a dentist immediately for special treatment.

35c and 60c tubes in the United States and Canada. At all druggists.

Forhan Company, New York
Forhan's, Limited, Montreal

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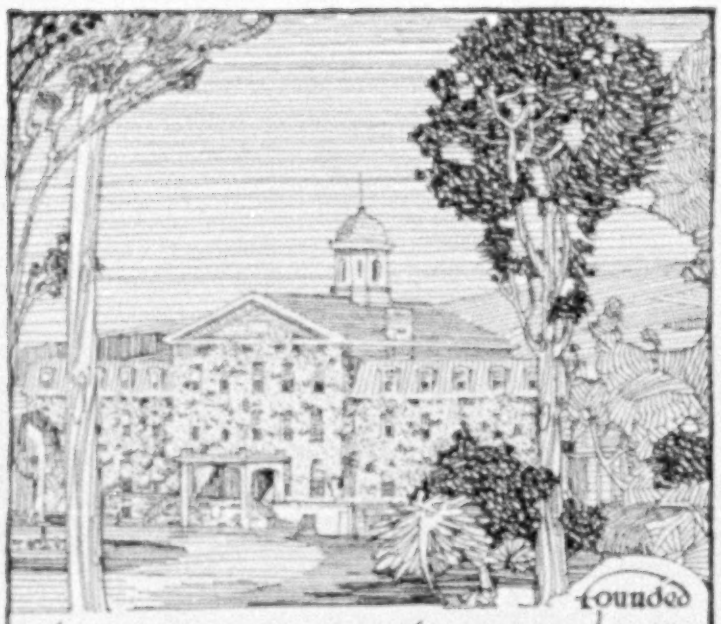


Founded

Highland Hall 1867

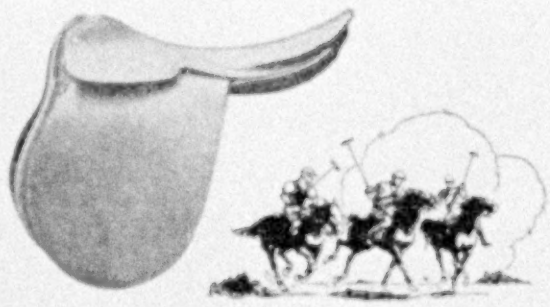
SCHOOL for GIRLS

In old residential Hollidaysburg located in the most beautiful and healthful section of the Allegheny Mountains, six miles by electric and steam trains from Altoona on Main Line of Penna-Railroad

College preparatory, General and Post-Graduate Courses.

Address Miss Ellen C. Keates, A.B., Principal. Hollidaysburg Pa.

Every Whitman Saddle bears the Silver Shield Trade Mark



Whitman English Type Park, Hunting, and Polo Saddle

Where Health and Sport meet

For the man who would keep fit; for the woman who seeks to retain her youthful charm, there is no exercise more healthful, or more pleasant, than riding.

To gain full benefit, however, from your morning canter, you should have a Whitman Saddle—the saddle that fits you and your mount perfectly. The tree and coverings of this seat are made of the most select materials; the workmanship is that of expert saddlers.

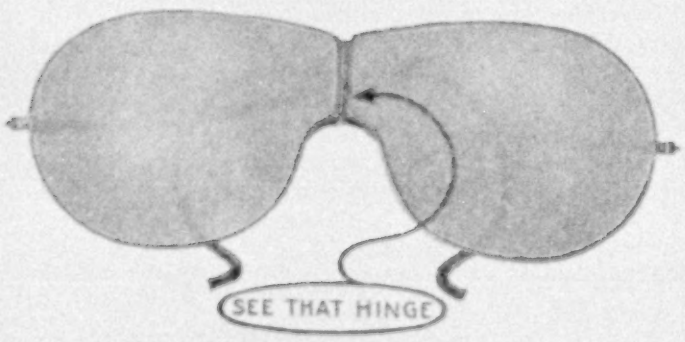
See this saddle at your local shop or at either of our equestrian showrooms:

89 Chambers St., New York City
1329 S. Michigan Ave., Chicago

The Perkins-Campbell Company, Cincinnati

DeLuxe book of saddles loaned on request

The AUTOGLAS



PATENTED MAY 2, 1911

Comfortably protects the eyes of those who take pleasure in outing. Motorists, Golfers, Tourists, Hunters, Trap-shooters and Fishermen find they prevent the discomforts caused by dust, wind or flying particles.

For sale by Opticians, Motor Supply and Sporting Goods Establishments. We will gladly furnish the address of your nearest dealer.

F. A. HARDY & COMPANY

Department R. Box 804, Chicago, Ill.

TYROL WOOL

REG. U.S. PAT. OFF.

Tyrol Wool is a knitted all-worsted fabric, finely finished, damp-proof, non-wrinkling, and has endless wear.

Suitable for all climates and outdoor occasions.

Ladies' and Misses' Plain Tailored Suits and Top Coats

$29.75 to $66.75

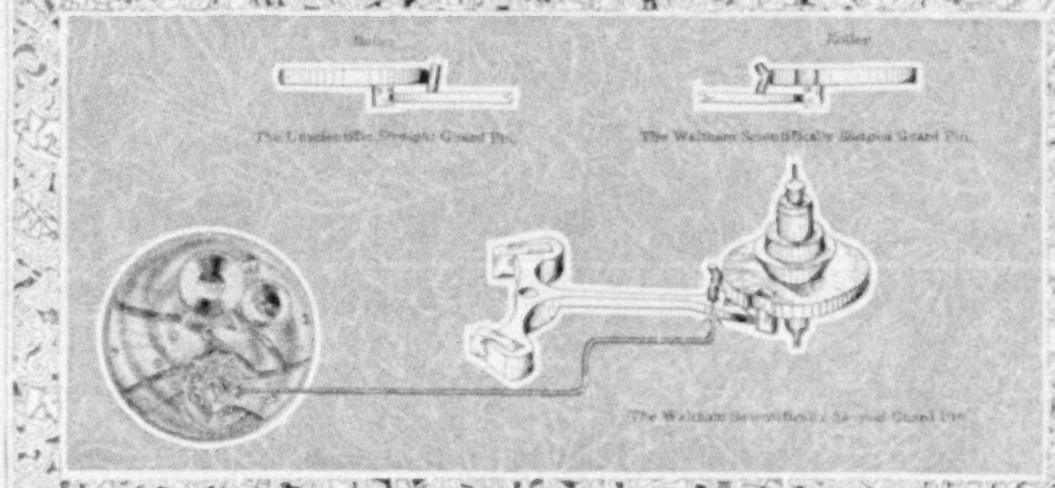
Priced as to style, weight, and color.

Illustrated catalogue and samples on request. Mail orders filled.

MANN & DILKS

PHILADELPHIA, PA.

PROOF



THE MOST SCIENTIFICALLY BUILT WATCH IN THE WORLD

The Waltham Scientifically Shaped Guard Pin that Means So Much to You in Time-keeping Accuracy

JUST as the flange on the wheels of the railroad train keeps it from running off the track, so the Waltham scientifically shaped guard pin keeps the escapement from going out of action.

It is these little things of scientific construction which insure dependable performance. And this is particularly true of a watch.

This Waltham scientifically shaped guard pin is a development of Waltham genius—curved in shape for a reason, which overcomes the errors of time-keeping found in watches with a straight guard pin.

The position of any guard pin is determined by the diameter of the roller (illustrated above), and after the escapement has been adjusted, the guard pin is bent forward to within a third of the thickness of a human hair, to allow the roller to revolve freely, excepting when the watch receives an unusual jolt, and that is the time the guard pin functions.

In other words, the guard pin is a safety device to assure the perfect functioning of your watch.

You will notice in the illustration that the Waltham scientifically curved guard pin presents a single and infinitesimal point of contact with the roller, thereby reducing the possibility of friction which is the greatest enemy of good time-keeping.

The straight guard pin presents, if properly made, a plane of contact. If there should be any imperfection, the guard pin would have to be set at an angle. (See illustration above.) And this would make it impossible to properly adjust the guard pin.

Whereas the curved guard pin can be bent in any direction and it will still present its small area of contact, reducing friction to a minimum.

It is these tiny, exclusive units hidden in the works of the watch, involving years of study and invention, that assure you of precision time-keeping and durability when your watch selection is a Waltham.

Waltham 7½ Ligne

The movement is actually smaller than a dime in diameter

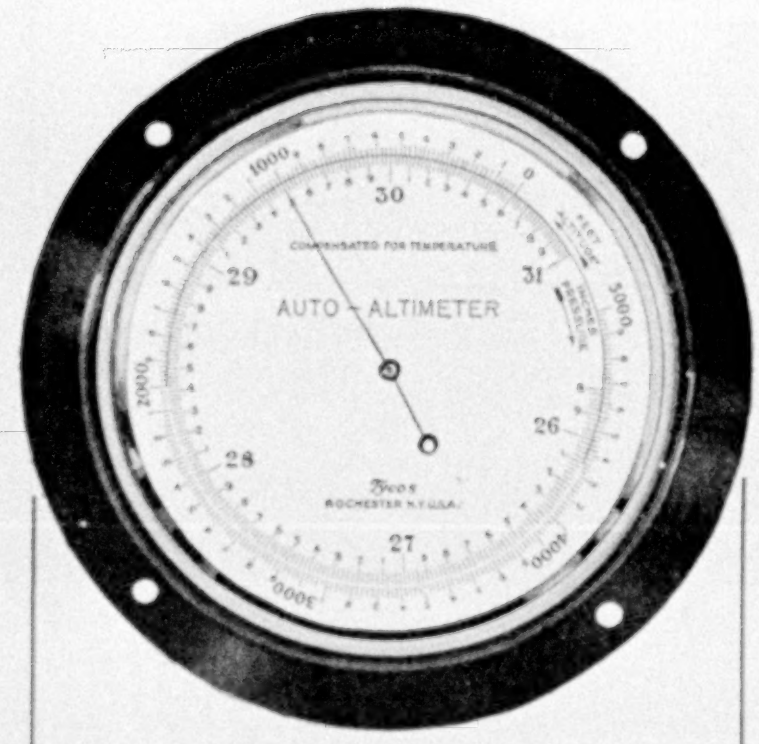
$250 to $1,500 or more depending upon the case

This story is continued in a beautiful booklet in which you will find a liberal watch education. Sent free upon request. Waltham Watch Company, Waltham, Mass.

WALTHAM

THE WORLD'S WATCH OVER TIME

"Mention The Geographic—It identifies you"



Motorists Will Appreciate This Instrument

To thoroughly enjoy touring you should know the elevations of the places through which you pass. It is not always convenient to consult a book or make computations, but it is very simple to glance at the easy-reading dial of a

Tycos Auto-Altimeter

and to know instantly just how high you are, either with respect to sea-level or the place from which you started. Two successive readings will tell you precisely how high one place is above another.

The *Tycos* Auto-Altimeter may be attached to any instrument board, in either offset or flush type. Aluminum case, handsomely finished in permanent black, heavily beveled glass, engraved silver dial $2\frac{1}{2}$" diameter. Three styles, reading to 5,000 feet, $35; to 10,000 feet, $36.50; and to 16,000 feet, $39.

On sale by many leading motor supply and optical dealers. Until such time as complete distribution is effected, instrument will be shipped direct to you upon receipt of price (and dealer's name). Safe delivery guaranteed. Folder on application.

Taylor Instrument Companies

Rochester, N. Y., U. S. A.

There's a *Tycos* or *Taylor* Thermometer for Every Purpose

(AL-5)

No Need to Dread This Task

Sani-Flush is made for just one thing—to clean your closet bowl easily and efficiently. Just sprinkle a little of it into the bowl according to directions; rust stains, markings, and sediment all disappear without scrubbing or scouring. *Sani-Flush* does its work so thoroughly that it leaves the bowl and trap as glistening white and odorless as new. This simple way of performing an otherwise unpleasant task should appeal to you.

THE HYGIENIC PRODUCTS CO.
525 Walnut Avenue, Canton, Ohio.

Canadian Agents
Harold F. Ritchie & Co., Ltd.
Toronto

Sani-Flush is sold at grocery, drug, hardware, plumbing, and house-furnishing stores. If you cannot buy it locally at once, send us 25c in coin or stamps for a full sized can postpaid. (Canadian price, 35c; foreign price, 50c.)

Sani-Flush

Cleans Closet Bowls Without Scouring

Kills!

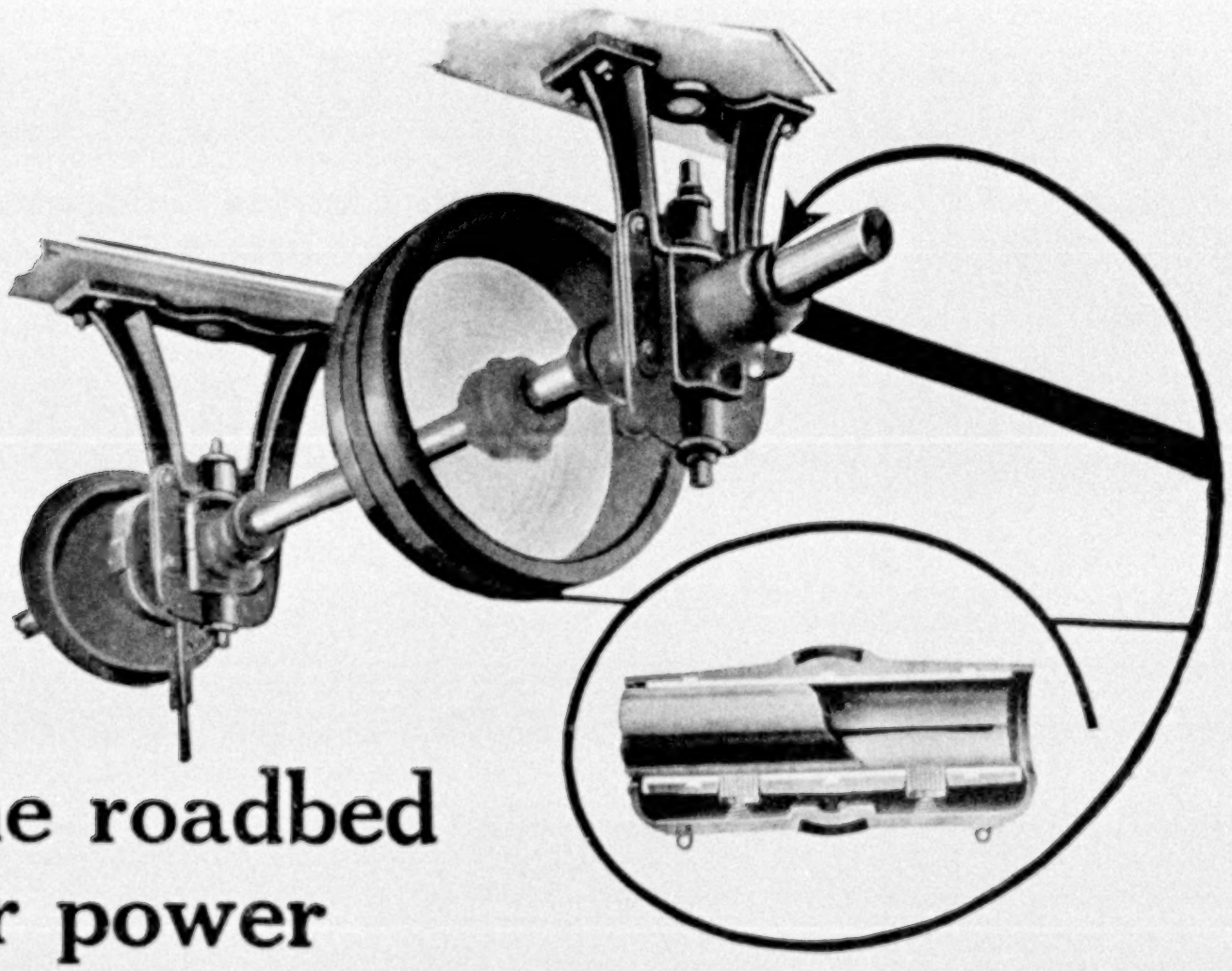
No Muss—No Mixing—No Spreading

Rat Bis-Kit quickly and surely does away with rats and mice. They die outdoors. There's a different bait in each Bis-Kit. No trouble. Just crumble up. Remember the name—Rat Bis-Kit. 25c and 35c at all drug and general stores.

The Rat Biscuit Co., Springfield, Ohio

Rat Bis-Kit

For Mice Too



The roadbed for power

The three primary requisites of a good bearing are:

1st—A proper bearing area.
2nd—Good babbitt.
3rd—A positive method of lubrication.

Upon these points depends whether or not the bearing in your plant will last two years or twenty.

Dodge self-oiling bearings are five times as long as the diameter of the shaft they carry—Dodge bearing metal is the final result of 30 years' experiment to find the best.

The self-oiling feature is positive—lubrication by capillary attraction is as unfailing as the law of physics which governs the application.

Dodge bearings are built for long, hard service; when shafts are properly aligned and installed they constitute the most economical and least troublesome "roadbed for power" possible.

DODGE

Dodge Sales & Engineering Company

Distributor of the Products of the Dodge Mfg. Company and the Dodge Steel Pulley Corporation

General Offices: Mishawaka, Ind. **Works: Mishawaka, Ind. and Oneida, N. Y.**
Canadian Plant: Dodge Mfg. Co. of Canada Ltd., Toronto and Montreal

"Mention The Geographic—It identifies you"

AROUND THE WORLD

The American Express Company

Announces Tours

From San Francisco

Sept. 17, Oct. 14, Nov. 13 and Dec. 11

Visiting Japan, China, Phillipine Islands, Singapore, Java, Penang, Burmah, India, Ceylon, Egypt, Naples and the Battle Fields of France.

From New York

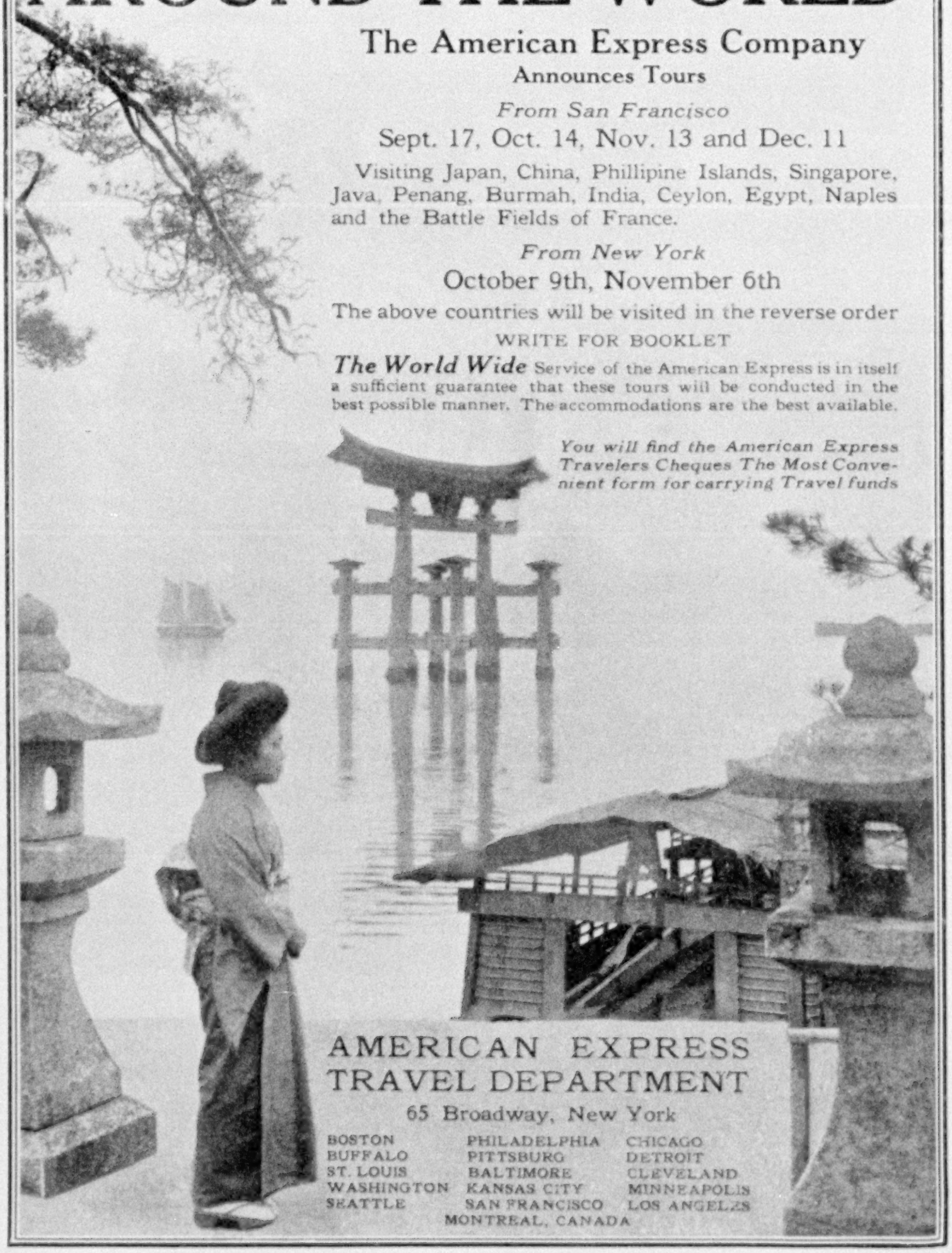
October 9th, November 6th

The above countries will be visited in the reverse order

WRITE FOR BOOKLET

The World Wide Service of the American Express is in itself a sufficient guarantee that these tours will be conducted in the best possible manner. The accommodations are the best available.

You will find the American Express Travelers Cheques The Most Convenient form for carrying Travel funds



AMERICAN EXPRESS
TRAVEL DEPARTMENT

65 Broadway, New York

BOSTON	PHILADELPHIA	CHICAGO
BUFFALO	PITTSBURG	DETROIT
ST. LOUIS	BALTIMORE	CLEVELAND
WASHINGTON	KANSAS CITY	MINNEAPOLIS
SEATTLE	SAN FRANCISCO	LOS ANGELES

MONTREAL, CANADA

A Boon to Travelers in Europe

A boon to travelers in Great Britain and France will be the new American Express Travelers Cheques, issued in Pounds Sterling and French Francs. At your home bank or express office you can buy Travelers Cheques good for a stated amount of British or French money, paying for them in dollars. Thus you are protected against mulcting by unscrupulous money changers and fluctuations in the rates of exchange. You receive a certain, definite number of Pounds or Francs — there is no doubt about the value of your Cheque — whether cashed at hotel, shop, restaurant, or tourist agency. There is no telephoning to banks for exchange rates, no guess work, for the amount to be paid is printed on the Cheque.

American Express Travelers Cheques

The new Cheques, like the American Express Dollar Travelers Cheques, are the safest form in which to carry travel funds. They are self identifying; you sign them when you buy them, you countersign in the presence of the one who cashes them. Your signature identifies you. The value of lost or stolen uncountersigned Cheques is returned to you upon filling out certain protective forms.

These Cheques are issued in handy amounts, the Sterling Cheque in five and ten pounds; the Franc Cheques in 200 and 400 French Francs — amounts equal in spending convenience to a $20.00 bill.

Outside of Great Britain, France and their Colonies, the regular American Express Dollar Travelers Cheque still offers the most valuable method of carrying travel funds.

The cost is fifty cents for each one hundred dollars

AMERICAN EXPRESS COMPANY

The Standard Safe 6% Investment

FOR 38 years S. W. Straus & Co. have been pioneers and leaders in the development of investment bonds which are unimpeachably conservative and fundamentally safe.

As a result of this consistent policy, the serial first mortgage bonds underwritten in accordance with the ***Straus Plan*** are today recognized as the standard safe 6% investment of the nation. Our booklet, "Safety and 6%," will tell you why. Write for it today. Ask for

Booklet E-1008

S.W.STRAUS & CO.

Established 1882 — NEW YORK — 150 Broadway
Incorporated — CHICAGO — Straus Building

Detroit Minneapolis San Francisco Philadelphia Cleveland Milwaukee Boston Indianapolis Washington Buffalo Los Angeles Pittsburgh

38 years without loss to any investor

BROWN BROTHERS & COMPANY

Established 1818

Philadelphia NEW YORK Boston

Letters of Credit

Information of value to the traveler is supplied in our new booklet, "Concerning Travelers' Letters of Credit." This explains how such letters may be obtained and their uses and advantages; also some account of our services and facilities for the tourist or business man presenting these letters in foreign countries.

Copy sent upon request

BROWN, SHIPLEY & COMPANY

Established 1810

Founders Court, Lothbury LONDON, E. C.

Office for Travelers 123 Pall Mall, LONDON, S. W.

Safety *and* Service *for* Subscriber *and* Advertiser

The National Geographic Magazine bases its advertising policy upon the unusually intimate relations which exist between its 750,000 owner-subscribers and the publication.

Its readers, as members of this great humanitarian organization, are more than mere subscribers to a periodical—have a very real, proprietary interest in the publication. They realize that all income from the Magazine is used to further the educational projects of their National Geographic Society. It is not surprising, therefore, that they usually speak of "*Our Magazine—The Geographic.*"

All advertising for the Geographic's pages naturally receives the closest scrutiny—the honesty of the offer, the high standard of the product—its interest to our readers and the value to the advertiser, make up the sum total of its admissibility.

For example, in the financial field, the Magazine accepts only the advertising of national banks and trust companies and of bond houses of the highest integrity, which have been in active business for at least ten years.

This rigid advertising policy, coupled with the mutuality of interest between subscriber and the Magazine, has resulted in implicit reader-confidence and in a maximum responsiveness to advertising from these 750,000 community-leading subscriber homes.

Thus every advertiser is sure of the company he finds himself in.

The National Geographic Magazine

Fifty-One Years Without Loss to an Investor

IN WASHINGTON the spirit of financial adventure does not abide in the shadow of the closely supervising United States Treasury. Investment in our First Mortgage Notes on Washington property is welcomed, therefore, by men and women whose savings or inherited wealth should be placed in securities not subject to the sudden changes and fluctuations of many investments in other parts of the country.

Our 6% First Mortgage Notes should appeal to you because they are safe, offer a liberal return, and are at par every day in the year.

Write for detailed information.

SWARTZELL, RHEEM & HENSEY CO.

SEVEN TWENTY NINE, FIFTEENTH STREET

Washington, D.C.

6%

25 Years of Safe Investment Service

For 25 years we have paid 6% on Time Certificates which are always at par—always worth 100 cents on the dollar plus interest. Interest checks mailed January and July.

If you have saved as little as $25 you ought to know about this old, reliable company.

Write for Booklet
"6% and Safety."

The Calvert Mortgage Company

877 Calvert Bldg. Baltimore, Md.

Don't Grope for Words

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VOL. XXXVII, No. 5 WASHINGTON MAY, 1920

THE NATIONAL GEOGRAPHIC MAGAZINE

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COMMON MUSHROOMS OF THE UNITED STATES

BY LOUIS C. C. KRIEGER

Continuing its policy of presenting to its readers comprehensive and especially timely articles and illustrations in color which stimulate a keener interest in and a more satisfying enjoyment of the glories and wonders of Nature's forests, plains, and hills, the NATIONAL GEOGRAPHIC MAGAZINE *publishes the accompanying series of matchless mushroom paintings and intimate descriptions by L. C. C. Krieger, who is associated with Dr. Howard A. Kelly, of Baltimore.*

The delicacy of coloring and variety of hues, the curious forms and astounding fertility of mushrooms, will amaze the reader. It is believed that Geographic members will take the same delight in their "Mushrooms" Number that they have expressed previously in such Nature-study numbers as "Birds of Town and Country," "American Game Birds," "Mankind's Best Friend—The Dog," "Our State Flowers," "Wild Animals of North America," etcetera.

The reader is especially cautioned, however, that the illustrations and text MUST NOT *be used as final authority in deciding whether a particular specimen is an edible or a poisonous fungus, because no treatise within the limits of a single number of even* THE GEOGRAPHIC *could be sufficiently detailed and complete to protect the novice against the deadly species, which are very numerous. For those who desire more detailed description of mushrooms, this article is being amplified with much technical data and can be obtained separately, bound in cloth, at $3.00 per copy, postpaid.*

MORE than thirty-eight million pounds of edible mushrooms were imported into our country during the five years immediately preceding the World War. In addition to this vast amount, we consumed not only the large output of our own growers, but quantities of wild species besides.

The species imported from France comprise the cultivated variety of the common meadow or pasture mushroom, *Agaricus campester* (for illustrations see Plate I and page 400); the expensive truffle; the cèpe (*B. edulis*, illustrated in Plate IV and on page 406).

China sends us certain species largely for the use of her own people resident among us. Our own producers limit themselves to the cultivated variety of the meadow mushroom.

The names of the wild species marketed cannot be ascertained definitely, since there is with us no such legal control of the sale of mushrooms as obtains in most cities in continental Europe. Gatherers in the United States either eat their finds themselves or sell them promiscuously to any mushroom-hungry individual who has the temerity or the knowledge to venture purchasing.

Photograph by A. G. and B. Leeper

ONE OF THE POISONOUS MEMBERS OF THE AMANITA MUSHROOM FAMILY

The top view of the specimen on the right shows that the deadly Amanitas peel as readily as the edible mushrooms. "Peeling" is, therefore, no sign of edibility.

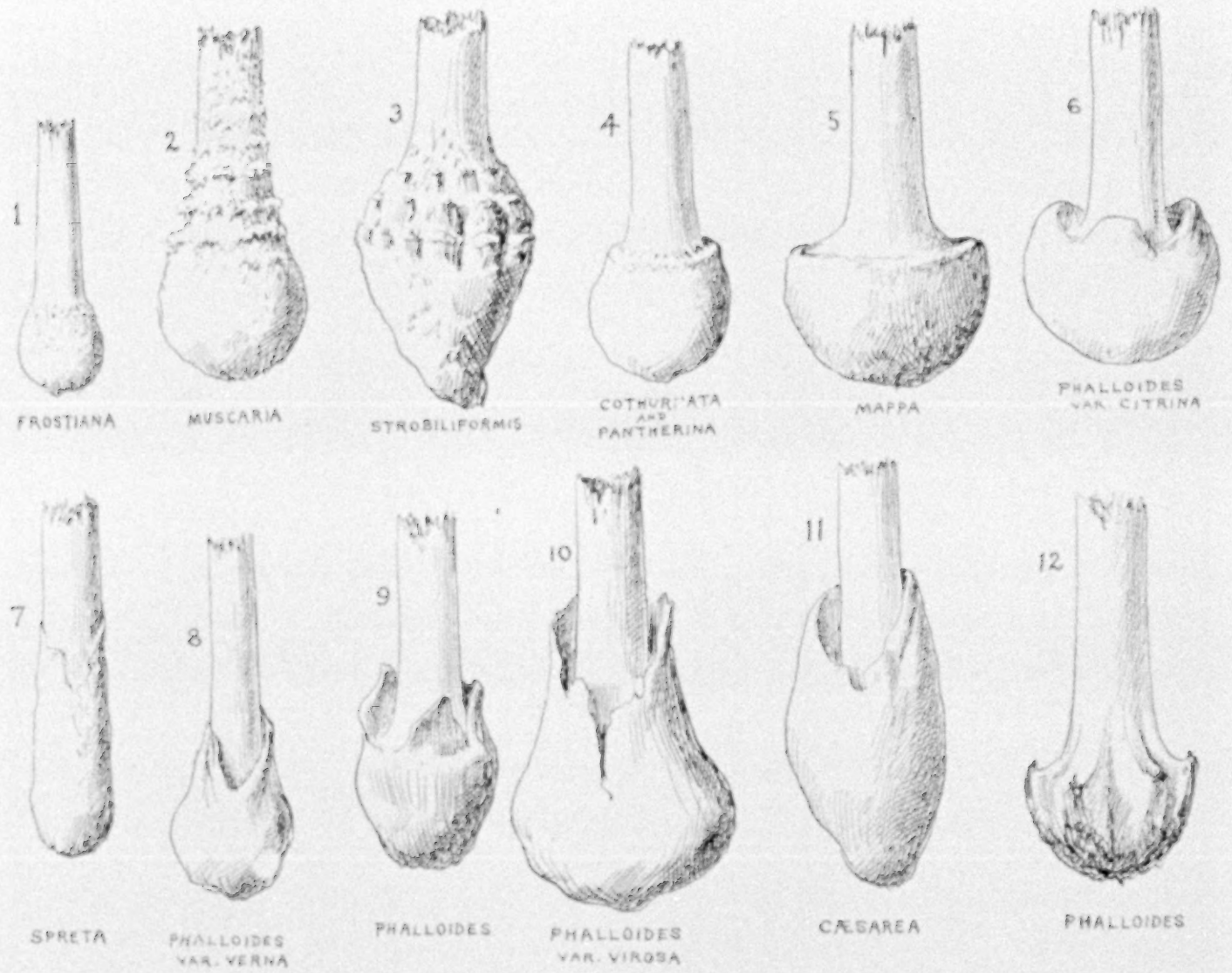
From personal observation, however, and from a perusal of the popular literature which advises the consumption of certain species, we may judge that the following species most frequently find their way into the kitchen: *Agaricus campester, Agaricus arvensis* (see Plate I), the Parasol mushroom (*Lepiota procera,* see Plate XIV), certain species that grow on trees (*Pleurotus ostreatus,* etc., see page 402), ink-caps (species of Coprinus, see Plates VIII and XII), "fairy-ring" mushrooms (see page 397), puff-balls (pages 414-419), and, of course, Morels (Plate VII and pages 420, 421).

Since the establishment of mushroom or mycological clubs in some of our large cities, considerable interest has been aroused, with the result that members and their friends have learned to recognize many of the lesser known, yet equally safe and good species. The war, too, has had its effect. Food is scarce and high-priced, and people, following suggestions offered in the public prints, are turning to hitherto unknown or disregarded sources of food supply, including the spontaneously growing crop of wild mushrooms.

RATTLESNAKE DENS VERSUS POISONOUS MUSHROOMS

But those who, unadvised or ill-advised, would gather wild species for the table should remember that they are embarking upon an adventure that may lead to a sudden and horrible death.

To ask a person to gather his own mushrooms for the table, without previous instruction that will enable him to avoid the deadly kinds, is equivalent to, if not worse than, inviting him to put his unprotected hand into a den of rattlesnakes. Indeed, of the two risky performances, the latter would be the safer; for there are at least two known antidotes for rattlesnake venom, whereas there is none for the poison or poisons of the exceedingly common *Amanita phalloides* (see Plates X and XVI) and its multitudinous forms and varieties.



THE DANGER SIGNALS, OR DEATH-CUPS, WHICH NATURE PLACES ON THE BASES OR UNDERGROUND PORTIONS OF THE AMANITA SPECIES

The death-cup is technically knowu as the volva and at first encloses the entire plant just as the egg-shell does the egg. As the plant grows the stem lengthens, and in doing this ruptures the bag. The illustration shows how the death-cup, or volva, differs in structure with the various species of Amanita. There are two distinct types of death-cups, the bag-like type (Nos. 10 and 11), and the more or less fragile, crumbling, or scaly type (Nos. 1, 2, and 3). Both types are subject to variation, the variations being characteristic for different species or groups of species. Number 7 represents a diabolical attempt on the part of one Amanita to camouflage its identity, both bulb and bag-like volva being difficult to discern. A reduction of the "friable" (crumbling) type of volva is seen in No. 1, only a few grains being left to tell the tale, and sometimes even these are absent. When absent from the bulb, however, they are usually to be found on the ground, leaves, twigs, or needles immediately surrounding the base, or on top of the cap, where they form warts, provided rain has not washed them away. The beautiful *Amanita cæsarea*, Plate IX, and the Blusher (page 390) are two exceptions in the dangerous Amanita family, being edible though possessing death-cups.

In this connection it is of interest to note that poisonous serpents and fungi were associated in the mind of man from early times.

Pliny writes: "Noxious kinds must be entirely condemned; for if there be near them a hobnail or a bit of rusty iron or a piece of rotten cloth, forthwith the plant, as it grows, elaborates the foreign juice and flavors into poison; and country-folk and those who gather them are alone able to discern the different kinds.

"Moreover, they imbibe other noxious qualities besides; if, for instance, the hole of a venomous serpent be near and the serpent breathe upon them as they open, from their natural affinity with poisonous substances, they are readily disposed to imbibe such poison. Therefore one must notice the time before the serpents have retired into their holes."

Were it not that the subject is such a serious one, we should feel inclined to laugh at the simplicity of the ancients.

Photograph by A. G. and B. Leeper

THE BLUSHER (*Amanita rubescens*) IS EDIBLE

There are many thousands of species of mushrooms and many strange forms, as the succeeding photographs show. The collector observes especially variations in the cap (1), gills (2), ring (3), stem (4), volva (see page 389), and color of the spores (for an account of these marvelous reproductive bodies, see pages 392, 402, 415).

Though edible, the Blusher is a member of the dangerous genus Amanita, and should therefore be eaten only by those who are thoroughly familiar with a large number of Amanitas. Its volva has disappeared into warts on the cap, see description of figure 1, page 389. It may be yellowish, entirely white, and often very much deformed or aborted in shape, and quite frequently specimens are found that refuse to "blush." The Blusher is found in thin and dense woods, solitary or scattered; time, July to September; distribution, United States, east of the Mississippi, and in Europe. About natural size. For color figures of Amanitas, see Plates II, V, IX, X, XV, and XVI.

Curiously enough, some of the ancient beliefs as to the origin of poisonous fungi persist at the present time in Italy. A Sicilian laborer whom the writer interrogated on the "funghi," vouchsafed the "information" that the poisonous kinds grow from rusty iron (nails, etc.) in the ground, but that they are easily to be distinguished from the wholesome kinds in the process of cooking by simply dropping a piece of bright silver (a new coin or the like) into the stew: if the fungi are poisonous, the silver will blacken; if not, it will retain its luster. The efficacy of this "test" is believed in by an astonishing number of people.

But not only tradition is active in promulgating error in this life-and-death matter. Newspapers occasionally and inadvertently publish "general rules" that are often misleading. For example, an article in a representative daily in one of our large cities, after assuring the reader that there are but six poisonous kinds among more than a thousand, adds:

"No poisonous mushroom is ever found growing in cluster form."

In refutation of such a generality, the reader is referred to the symptom produced by *Clitocybe illudens*, a poisonous, though not a deadly poisonous, agaric that grows in dense clusters (see Plate III and text, page 403).

GENERAL RULES FOR BEGINNERS

General rules for the guidance of mushroom-hunters are trustworthy and serviceable only when formulated by experienced botanists. The following six rules* by the late Dr. W. G. Farlow, Professor of Cryptogamic Botany in Harvard University, will prevent, if scrupulously observed, the eating of notoriously poisonous species:

"(1) Avoid fungi when in the button or unexpanded stage; also those in which the flesh has begun to decay, even if only slightly.

"(2) Avoid all fungi which have death cups, stalks with a swollen base surrounded by a sac-like or scaly envelop, especially if the gills are white. (Study the Amanitas and diagram, page 389.)

"(3) Avoid fungi having a milky juice, unless the milk is reddish.

"(4) Avoid fungi in which the cap, or pileus, is thin in proportion to the gills, and in which the gills are nearly all of equal length, especially if the pileus is bright-colored.

"(5) Avoid all tube-bearing fungi in which the flesh changes color when cut or broken or where the mouths of the tubes are reddish, and in the case of other tube-bearing fungi experiment with caution.

"(6) Fungi which have a sort of spider web or flocculent ring round the upper part of the stalk should in general be avoided."

Professor Farlow adds that "Rules 1, 2, and 5 may for the beginner be regarded as absolute, with the exception to Rule 2, *Amanita cæsarea* (Plate IX), the gills of which are yellow. Rules 3, 4, and 6 have more numerous exceptions, but these rules should be followed in all cases unless the collector is content to experiment first with very small quantities and learn the practical result."

Other rules that will help to protect from serious poisoning are:

Do not collect mushrooms in or near wooded areas except for study purposes.

This rule is very general, as it does not protect against the green-gilled Lepiota (see illustration on page 393), nor against an occasional Amanita and some others; but it does prevent the beginner from entering the very "lair" of the man-killers.

Do not accept mushrooms from a self-styled expert, even if you have to disoblige a dear friend. Learn the subject yourself.

That an animal (insect, squirrel, turtle, etc.) has eaten of a mushroom is no criterion of the edibility of that mushroom for man. Insect larvæ thrive and grow fat on the violently poisonous *Amanita phalloides* (Plates X and XVI).

Soaking or boiling in water does not render a poisonous species edible.* The poisons of *Amanita phalloides* are destroyed only by continued boiling in powerful acids. (Dr. W. W. Ford.)

* Published in Bulletin No. 15, U. S. Dept. of Agriculture, Washington, D. C.

* J. Henri Fabre, in his "The Life of the Fly," relates that the peasants of Sérignan, in the south of France, render such notoriously poisonous species as *Amanita pantherina* and *Amanita citrina* (Plate V) edible by parboiling in water. Other reliable evidence speaks against this practice, however.

The truth is that inviting any one to become a mushroom-eater is tantamount to asking that person to become somewhat of a botanist, assuming, of course, that one has no ulterior motives on his or her life.

HOW WE MAY ACQUIRE THIS KNOWLEDGE

The preceding paragraphs are likely to dampen the ardor of those who would be pleased to learn how to collect and select their own mushrooms, but who are not sufficiently interested to go to the length of acquiring the necessary knowledge that will enable them to do this with safety. Those who are so affected had better do without mushrooms for the rest of their lives, bearing in mind that, so far, there is no "player attachment" to the study of mushrooms.

The most expeditious way of acquiring this knowledge is to join a mushroom club, if there happens to be such an organization in the city of one's residence. Boston, Philadelphia, Washington, and Detroit have, or have had, such clubs.

MUSHROOMS ARE THE FRUIT OF FUNGI

The removal of the bark from a rotting tree-trunk or the disturbance of the dense mat of decaying leaves on the floor of the forest will reveal fine threads, usually white in color. These threads may be loosely scattered and mould-like, compacted into a dense meshwork of cords, or spread out in flat sheets of the texture of white kid leather. In old mines the timbers are often festooned with long streamers of this soft substance, which to botanists is known as "mycelium," to mushroom growers as "spawn."

As every one who has cultivated these plants knows, mushrooms grow from these threads, not, however, as the apple tree grows from its roots, but rather as the apple grows on the tree, for the mycelium is the plant, the mushroom the fruit.

THE MARVELOUS SPORES

Every mushroom species arises from a mycelium of its own; yet, to distinguish between species, students rely exclusively on the forms, colors, and microscopic characters of the fruit-body (the mushroom), the mycelium rarely presenting characters sufficiently distinct for identification purposes.

The forms of mushrooms are extremely varied, but all have in common the ripening and liberation of the microscopic spores ("seeds" or reproductive bodies), by means of which the species are enabled to spread over wide areas. Some of the remarkable qualities of these spores are told on pages 402 and 415.

The mushroom collector can make some interesting experiments with the spores, as follows:

If the expanded cap of the common pasture mushroom (*Agaricus campester*) (see Plate I) be removed from its stem and placed upon a sheet of white paper, gill side downward, and left there under cover of a finger-bowl for an hour or two, there will be formed a beautiful deposit ("spore-print") of the microscopic, purple-brown spores.

If an Amanita (Plates II, V, IX, X, XV, and XVI), a Lepiota (Plate XIV), a Tricholoma (Plate VII), a Clitocybe (Plate III), or an Armillaria (Plate VI) be treated in the same way, a white spore-print will result. With a Volvaria (Plate V) the deposit will be reddish or pinkish. Pholiotas (Plates VIII and XIII) and Cortinarii (Plate VII) will throw down spores of some shade of brownish yellow, rusty brown, or cinnamon. Coprinus (Plates VIII and XII) and Panæolus (Plate VIII) species precipitate black or blackish spores.

Similar experiments may be made with other varieties.

FUNGI IN NATURE'S ECONOMY

The Fungi, a class of plants of which mushrooms are the most familiar examples, play an important rôle in their influence on the higher forms of life. As parasites on plants, animals, and man, they cause destruction on an almost incalculable scale. As scavengers and as rock-disintegrators, on the other hand, they accomplish work that is basic for the very existence of all life.

Rock is the raw material of the farmer's soil; but before the farmer can have this soil it must first be made. How is it made?

Violent weather changes—heat, cold, rain, snow, and ice—start the breaking-up process. Associated with these agencies, the lichens begin their work. Dry, crusty things, these plants produce an

Photograph by C. Cramer

THE GREEN-GILLED LEPIOTA (*Lepiota morgani*) IS POISONOUS

Beware of this false Parasol mushroom. It differs from the true edible Parasol mushroom (Plate XIV and page 439) in its greenish gills, coarser scales, and larger size. These two young specimens were photographed on a lawn in Washington, D. C. Approximately natural size. This Goliath of Mushrooms, the green-gilled Lepiota, is especially plentiful in the Mississippi Valley, but it also occurs in the Middle and South Atlantic States, in South America, in the West Indies, and probably in Bohemia and in the Philippines. Its habitat is in rich pastures, cultivated ground, in open woods, and on lawns in cities; time, June to October.

Photograph by George Shiras, 3d

THE EDIBLE HONEY-MUSHROOM (*Armillaria mellea*) "FINISHING" A TREE

This mushroom is the bane of the orchardist. The growth extended eight feet up the maple tree and four feet at the base (see text, page 411, and Color Plate VI, upper figure, and opposite page).

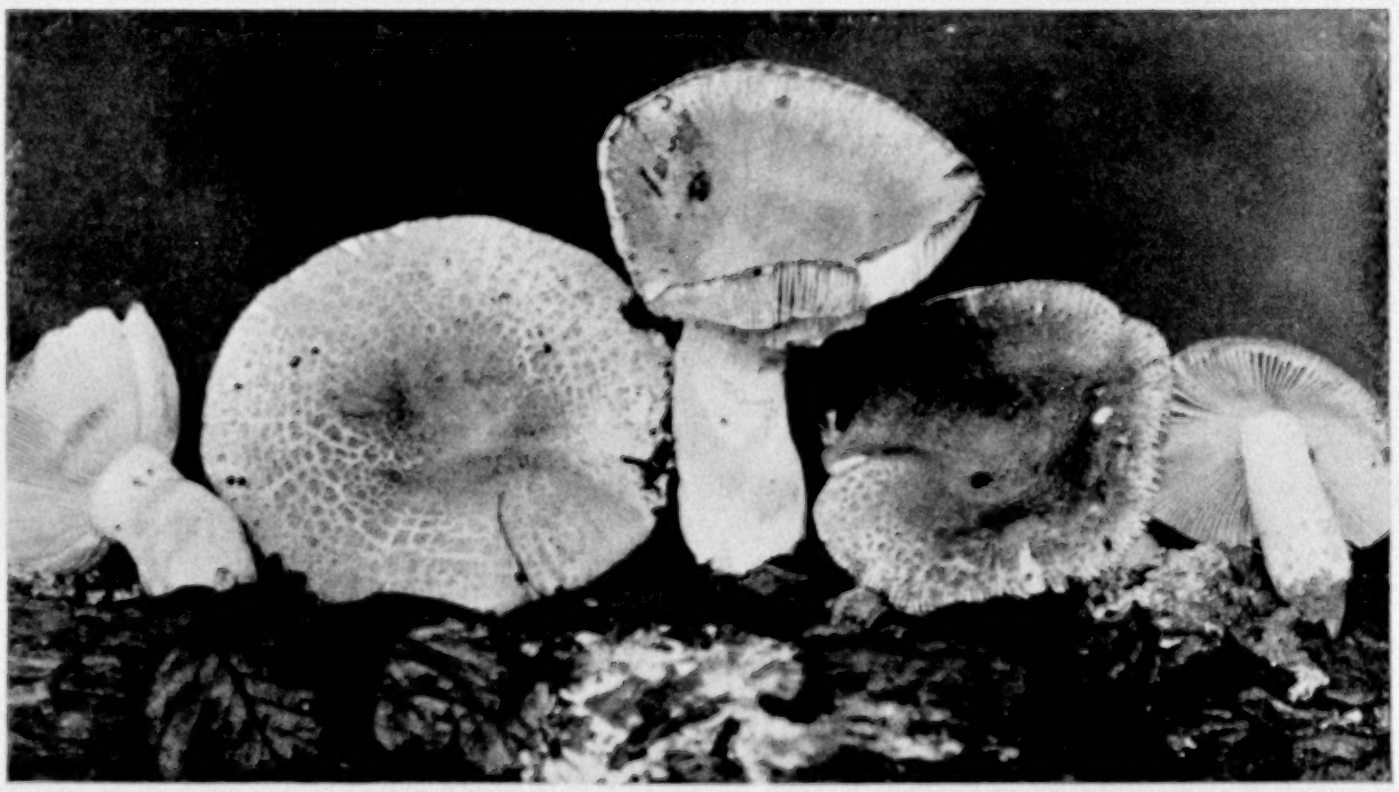
Photograph by George Shiras, 3d

"A TRAGEDY IN THE FOREST"

Armillaria mellea is here shown at its destructive work. This tree is doomed. This species of fungus is also shown as the upper figure of Color Plate VI and on opposite page. If you chop off the mushrooms, others will soon replace them, for they are simply the fruit of a parasite infesting the tree (see page 392 and the bracket fungus, page 400).

THE ABORTIVE CLITOPILUS (*Clitopilus abortivus*) AND ABORTIVE FORMS, THE LATTER SHOWN ON THE RIGHT. EDIBLE. ONE-HALF NATURAL SIZE

The eye that is sensitive to subtle color arrangements always meets with pleasure the unobtrusive habitant of our woodlands, known as the Abortive Clitopilus. When specimens are found, they are almost invariably accompanied by the odd, puff-ball-like masses, 1¼ to 2½ inches in diameter, irregular in shape, and of a whitish tint, shown in the right of the photograph. It would be interesting to ascertain whether these queer masses are caused by insects or by some parasitic fungus. An inspection of the interior will show that there is no differentiation of tissues into cap, stem, and gills. Similar masses are found accompanying the Honey mushroom (see Color Plate VI) and other species. Both the perfectly developed and the aborted forms are edible. They should be thoroughly cooked to bring out the flavor.



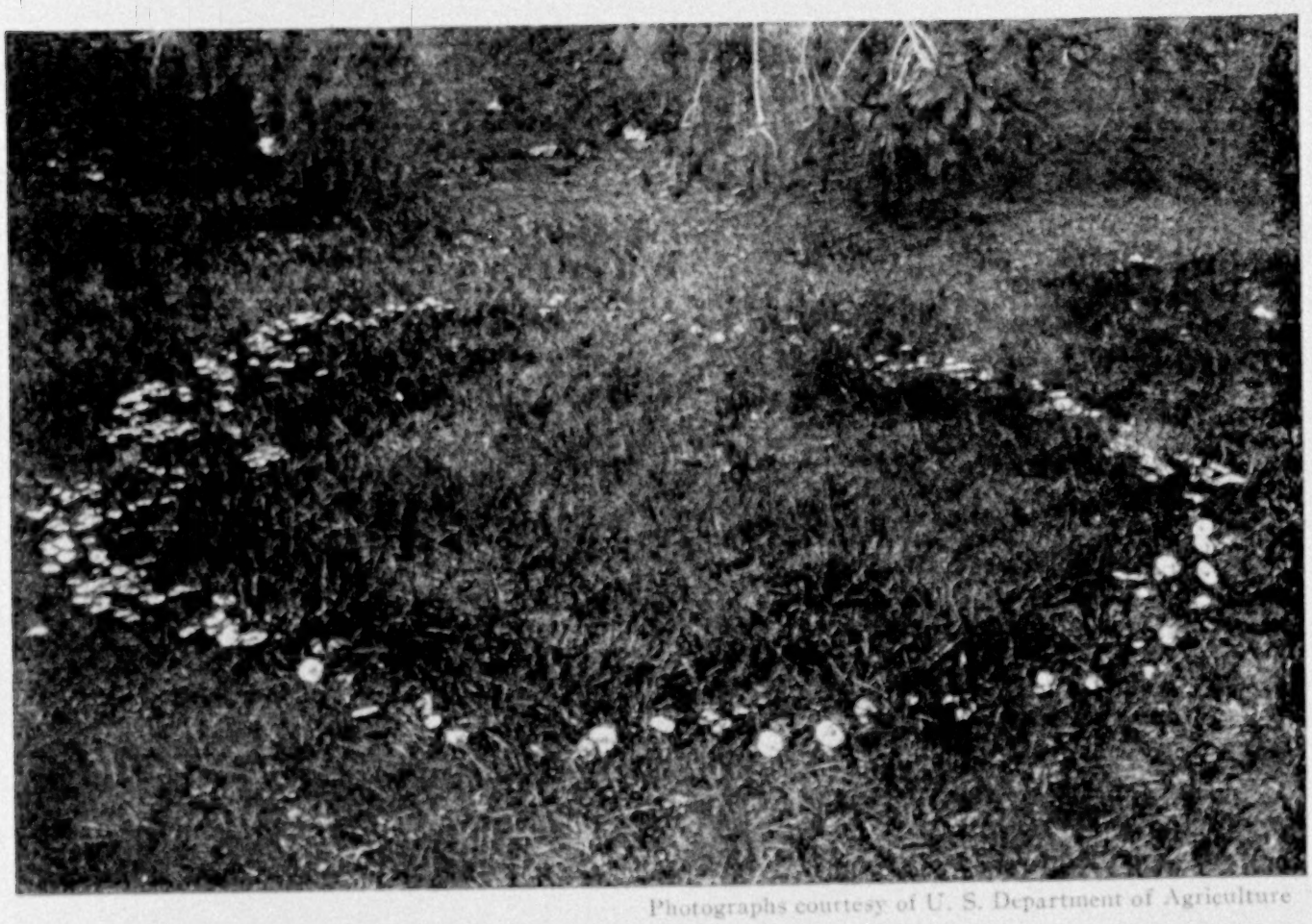
Photographs by A. G. and B. Leeper

THE GREENISH RUSSULA (*Russula virescens*). EDIBLE

The various Russulas are difficult to distinguish from each other. This species, however, is sufficiently well marked to be recognized by the layman. Painted with the hues of the rainbow, the Russulas bring a touch of brightness into the gloomy depth of the forest. Vivid reds, greens, purples, violets, and yellows predominating, these conspicuously colored agarics are at the same time the joy of the painter and the despair of the student who attempts their classification. The Greenish Russula grows in thin woods and in grassy, open places; time, July and August; distribution, Maine to Virginia, and west to Ohio and Michigan; also in Europe. About one-half natural size.

THE FAIRY-RING MUSHROOM (*Marasmius oreades*). EDIBLE

The specimens shown grew in the grounds of the White House, Washington, D. C. Approximately one-half natural size.



Photographs courtesy of U. S. Department of Agriculture

A "FAIRY-RING" FORMED BY *Marasmius oreades*, ONE OF THE BEST EDIBLE MUSHROOMS

The beginning of a "fairy-ring" may be a single mushroom which drops its spores or seeds in a circle about the base. The next season the small ring of mushrooms drops a larger ring of spores, and so the circle expands, year by year, exactly as the ripples spread out on the surface of a millpond when a rock is cast into the water. Fairy-rings, formed in Colorado, have been estimated to be about 600 years old. Legend informs us that these rings are the magic circles within which elves and other nimble fairy folk hold their revels at midnight on our lawns. There is another superstition that the rings mark the spots where bolts of lightning have struck the ground. *Marasmius oreades* is found in grassy places (lawns, pastures, and by the roadside) from May to October, being widely distributed in both the North and South Temperate zones.

THE VELVET-STEMMED COLLYBIA (*Collybia velutipes*). EDIBLE

In winter time the mushroom lover yearns for a taste of wild species. This he may have if he will be on the lookout for this tree-inhabiting Collybia. About one-half natural size. With its stem encased in a suit of dark-brown velvet, its rich yellow cap protected by a mucilaginous covering, the plant is admirably adapted to stand the rigors of the boreal season. This mushroom is gathered in the spring, autumn, and winter; distribution, eastern United States as far west as Kansas and Iowa; probably in the Pacific Coast States; also in Europe and Mexico; a variety (*spongiosa*) in Alaska.

Photographs by A. G. and B. Leeper

THE ROOTED COLLYBIA (*Collybia radicata*). EDIBLE

With its yellow-brown, wrinkled caps perched on a tall stem, this Collybia is met with almost immediately one enters a beech or pine forest. About one-half natural size.

acid that crumbles the hardest rock. Rains wash the disintegrated particles into cracks, crevices, and crannies down a slope. The remains of the dead lichens are added to the débris to form the first beginnings of soil in which other lichens, small ferns, and seed plants find a place to thrive and eventually die, each plant leaving behind some small particles of matter. Gradually, with infinite patience, Nature thus deposits soil in the valleys.

Ages of this slow but cumulative work, in which soil bacteria and other fungi play an essential rôle, and we have rich, virgin soil ready to receive the precious grains of wheat. Then the eye of hungry man is gladdened by the sight of acres of the golden crop.

FUNGI RAISE THE DOUGH

Bread made from unleavened dough is not to the taste of most of us. It must be light and spongy to be palatable. To obtain these qualities we are again dependent on the fungi. The good housewife buys yeast, dissolves it in water, and adds the fluid to the heavy dough, which is then thoroughly kneaded and set aside overnight in a suitable temperature. The next morning she is pleased to note that the dough has risen. After further kneading, it is placed in the oven and baked into appetizing loaves. On being cut, the bread exhibits a multitude of small bubbles of nearly equal size.

The little Brownies that labored while others slept are microscopic fungus cells that were introduced with the yeast. Given sugar, starch, moisture, and warmth, these cells multiply with incredible rapidity, at the same time giving off carbon-dioxide and another product. The carbon-dioxide gas collects in bubbles, and thus distends and lightens the dough.

If bread be left in a moist place it will mould. Here, too, we have fungous action.

Moulds, like bacteria and yeast fungi, are ever present and ready to alight and feed upon organic substances suitable to their taste. Roquefort cheese owes its flavor to a certain mould. Another is known to plug up the human ear.

Some of the industries in which the action of the ferment fungi is essential are: The making of buttermilk and cheese, the tanning of leather, tobacco-curing, the fermentation of vegetables (sauerkraut, fodder in silos, etc.), all bread-making where yeast is used, and all fermentation processes in which alcohol is produced.

FUNGI DESTROY WHEAT, TREES, AND WOOD

In 1916 the black-stem rust destroyed in the United States and Canada 280,000,000 bushels of wheat. Add to this a 15 to 25 per cent reduction of the barley and oats crops, and we become aware of the appalling destruction that a single fungous disease can cause.

One of these, *Endothia parasitica*, threatens with extinction the glorious chestnut trees of our eastern coast. The disease caused by this fungus fiend, the chestnut bark disease, starting in the vicinity of New York City about 1904, spread rapidly as far north as New Hampshire and south to Virginia. In its devastating march it has destroyed timber valued at more than two hundred million dollars, and the end is not yet.

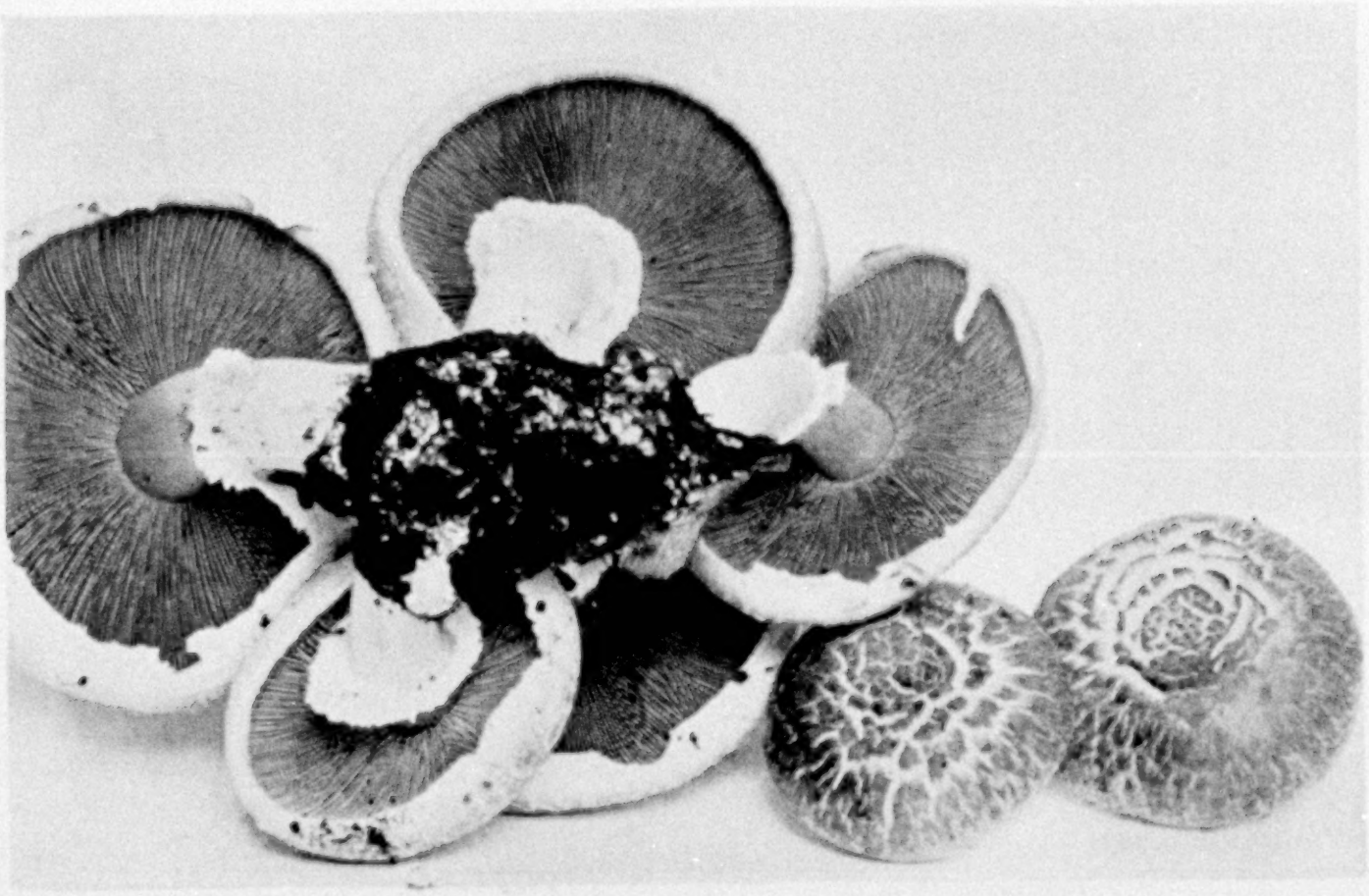
Another disease, the white pine blister rust, though not yet as widely known as the chestnut disease, is likely to become so unless preventive measures are adopted and coöperatively carried out by the States concerned.

While the destruction of living woody tissues is steadily going on in the forests, dead wood, including that used in buildings, railroad ties, etc., is likewise being destroyed by species that specialize in saprophytism or scavenger-work.

ANTS "CULTIVATE" MUSHROOMS

The almost human sagacity of the ant has interested man from earliest times. Isn't it possible that Homer called the Thessalian legions "myrmidons" because they swarmed like ants and fought with the cunning and bravery of these insect warriors? The foresight exhibited by the ant in storing its food, furnished Æsop with the theme for one of his most delightful fables. Later, upon closer observation, we were startled to learn that Mr. Ant is also a good "dairyman,"* milking his "cows" whenever he wants "milk"; but it was not until recently that

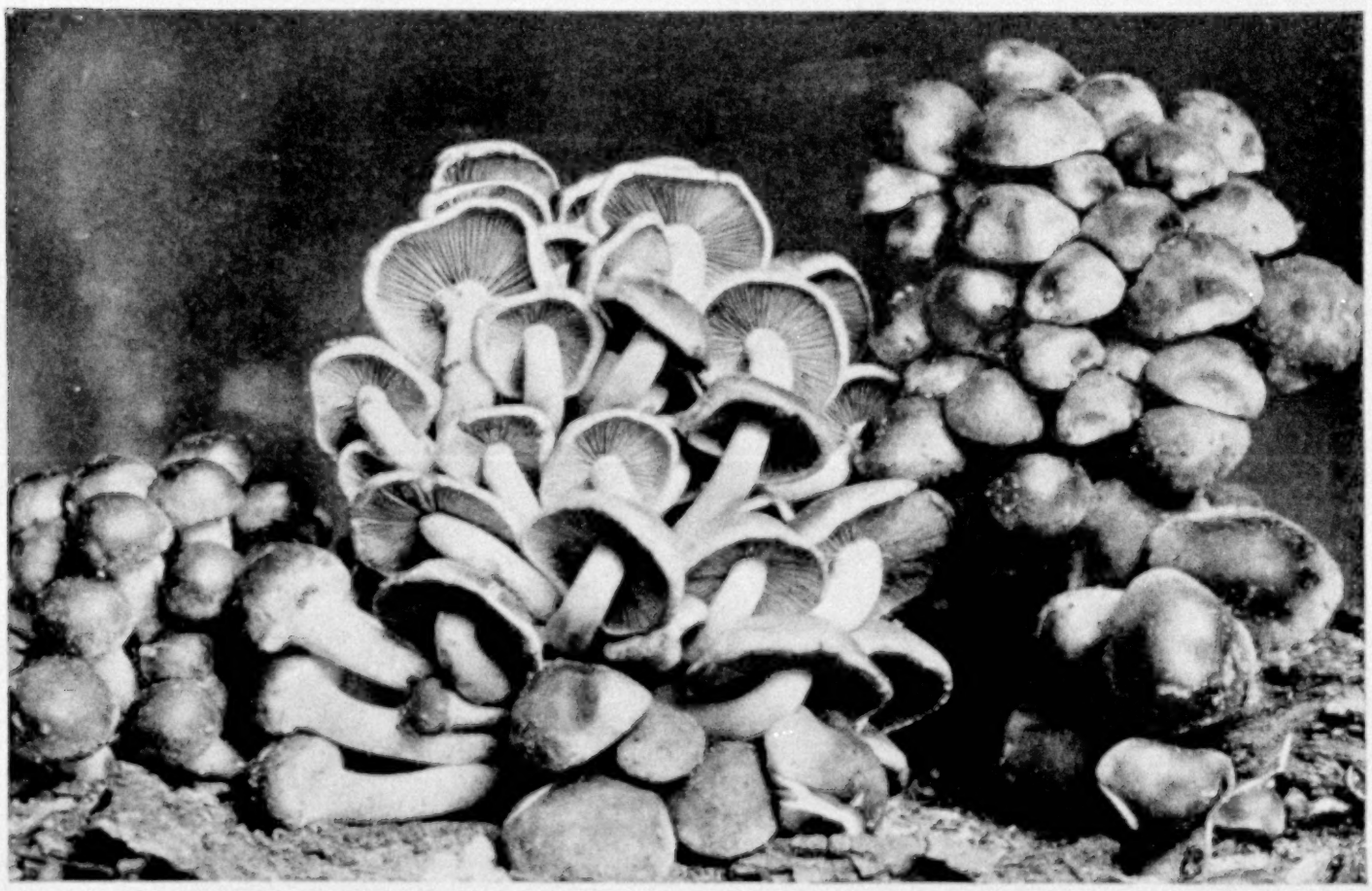
* See "Notes About Ants and Their Resemblance to Man," by Dr. William Morton Wheeler, in the NATIONAL GEOGRAPHIC MAGAZINE, August, 1912.



Photographs by A. G. and B. Leeper

THE COMMON MEADOW MUSHROOM (*Agaricus campester*). EDIBLE

Brownish, scaly variety above; white, smooth variety below. Before the war America imported annually millions of pounds of this delicacy from France, and our own producers and bountiful Nature have assisted materially in meeting the ever-increasing demand. Do not attempt to gather this or any other mushroom for eating purposes unless you have a competent authority with you (see Color Plate I and text, page 401). When picked they will fruit again as a continuous crop when cultivated in special mushroom cellars, and out-of-doors as long as the weather is propitious.



Photograph by A. G. and B. Leeper

THE BRICK-RED HYPHOLOMA (*Hypholoma sublateritium*). EDIBILITY DOUBTFUL

Few mushrooms are commoner than the Brick-top. It grows in dense clusters at the base of old chestnut and oak trees. About one-half natural size.

we were apprised of the fact that mushroom-growing is also one of his accomplishments.

Scientific travelers in Java and South America record that some of the larger species, the termites, construct veritable mushroom-cellars, in which they "cultivate" (on the mycelium of some large fungi) little globular bodies as food for themselves.

Mushroom-growing is a most uncertain business unless conditions favorable to the growth of the spawn are rigidly maintained. The ants know this, too, and take precautions necessary to insure a good "crop."

THE COMMON MEADOW MUSHROOM (Agaricus campester)

(*See Color Plate I*)

When the average person uses the word "mushroom" the common Meadow mushroom, or Pink Gill (*Agaricus campester*) is meant (see Color Plate I and photographs on page 400). Imported from France in enormous quantities before the war; cultivated by our own growers with ever-increasing zeal, and gathered in the wild state as soon as it makes its appearance in the fall, it is so well known that even the most timid feel no hesitation in ordering their juicy tenderloin "smothered with mushrooms."

The records, however, show that not infrequently other deleterious species are eaten along with, or in the place of, the common mushroom. It therefore behooves the eater of mushrooms to be as cautious with this species as he would be with one less well known.

Of course, only the most careless or uninformed would mistake the poisonous Amanitas for the Agaricus; but there are other poisonous species, not necessarily deadly, that are apt to get by the eye and into the mouth if one is unaware of, or neglects to observe, the botanical characters that distinguish the good from the bad. Species that are likely to be mistaken for the common mushroom are discussed further on.

Remarks on the preparation of the Meadow mushroom for the table are superfluous, as any cook-book will give full directions.

The common Meadow mushroom is at home in grassy places, lawns, pastures; never in thick woods; also (when cultivated) in cellars, caves, abandoned mines, and in other places where the temperature can be held between 50° and 65° F. and where moisture conditions can be controlled; time, when growing wild, in August and September, occasionally in the spring; when cultivated under suitable conditions, throughout the year; distribution, cosmopolitan.

Photograph by A. G. and B. Leeper

THE OYSTER MUSHROOM (*Pleurotus ostreatus*). EDIBLE

The name of the luscious bivalve was given this species because of a fancied similarity in appearance. The plants may be found from June until late in the Autumn, growing on deciduous trees. About one-third natural size.

If one has discovered one or more trees that bear Pleuroti, it is a good plan to water the spots from which specimens have been taken. In this way the plants may be "cultivated," as new "fruit" will appear in a week or two.

When specimens are brought indoors and placed in a sunny nook, away from drafts, the interesting phenomenon of spore-discharge may be watched. Like twisting, curling spirals of smoke from the burning end of a cigar, the fine spore-rain drifts off into space in quest of tree wounds where it may lodge and start a mycelium that in turn will produce more Pleuroti.

Related species and poisonous species are sometimes eaten in place of it, though *Agaricus campester* is so well marked that it is inconceivable how poisonous species, especially Amanitas, can be eaten by mistake.

A mere glance at the illustrations of the common mushroom and those of the Amanitas (see Plates II, V, X, XV, and XVI) ought to prove instructive, even to the most superficially observing, and, if in addition the descriptions be compared, wide differences will at once become apparent. To call attention to a few: *Agaricus campester* has a squattier appearance; lacks a bag, or volva; has pink gills that turn to a chocolate brown, and never grows in woods or forests, preferring rich, well-manured ground, such as old pastures, where horses are turned loose.

The Amanitas rarely occur anywhere except in woods, or in places where woods have recently stood, such as lawns in new suburbs; throw down from their gills a white spore-powder, and have, in addition to the ring, a more or less pronounced volva at the usually bulbous base of the stem (for figures of the various forms of the Volva, or Death-cup, see Nature's Danger Signals, page 389).

THE FIELD, OR HORSE MUSHROOM
(Agaricus arvensis). Edible

(See Color Plate I)

This coarse and heavy species is edible only when young and tender. Some epicures object to its anise-like odor. The distinguishing features are: its large size (breadth of cap sometimes more than a foot); peculiar ashy-pink tint of the young gills; large, thick, double ring (the lower one split radiately); the bulbous stem, and the tendency to turn yellow on the slightest bruise.

It is not so choice in its habitats as the common mushroom, growing in cultivated fields, grassy pastures, in waste places, under old hedges, and occasionally near trees, and in the borders of thin woods. It should be sought from July to September. Occasionally it forms huge fairy-rings (see page 397).

THE FLY MUSHROOM (Amanita muscaria and its varieties). Deadly poisonous!

(See Color Plate II for mature plant and Color Plate XV for young specimens)

Beauty, though attractive, is often deceptive. This is admirably illustrated in *Amanita muscaria*, the "most splendid chief of the agaricoid tribe," as Greville, an eminent Scotch botanist, describes it.

"In the highlands of Scotland," he continues, "it is impossible not to admire it, as seen in long perspective, between the trunks of the straight fir trees; and should a sunbeam penetrate through the dark and dense foliage and rest on its vivid surface, an effect is produced by this chief of a humble race which might lower the pride of many a patrician vegetable."

Contrast with this the dire effects of its poisons on the human system. Very shortly after eating the fungi (from one to six hours, depending upon the amount eaten) the victim exhibits excessive salivation, perspiration, flow of tears, nausea, retching, vomiting, and diarrhea. The pulse is irregular and respiration accelerated. Giddiness and confusion of ideas are also present.

Delirium, violent convulsions, and loss of consciousness develop in rapid succession when large quantities have been eaten, the patient sinking into a coma that is followed by death. In light cases the patient, after an attack of vomiting and diarrhea, falls into a deep sleep, from which he awakes several hours later profoundly prostrate, but on the road to recovery. Within two or three days, in such cases, complete recovery takes place.

Atropin is the perfect physiological antidote for muscarin, one of the poisons present. However, being a poison itself, it should not be administered except by a physician. The early appearance of the symptoms is characteristic of poisoning by this species, those caused by *Amanita phalloides* presenting themselves much later (see this species, Plates V, X, and XVI).

The *Amanita muscaria* is very common in woods, thickets, in open places, and sometimes in pastures, from June until the first frosts.

Photograph by George Shiras, 3d

A SPECIES OF PLEUROTUS MUSHROOM GROWING FROM A FALLEN LOG

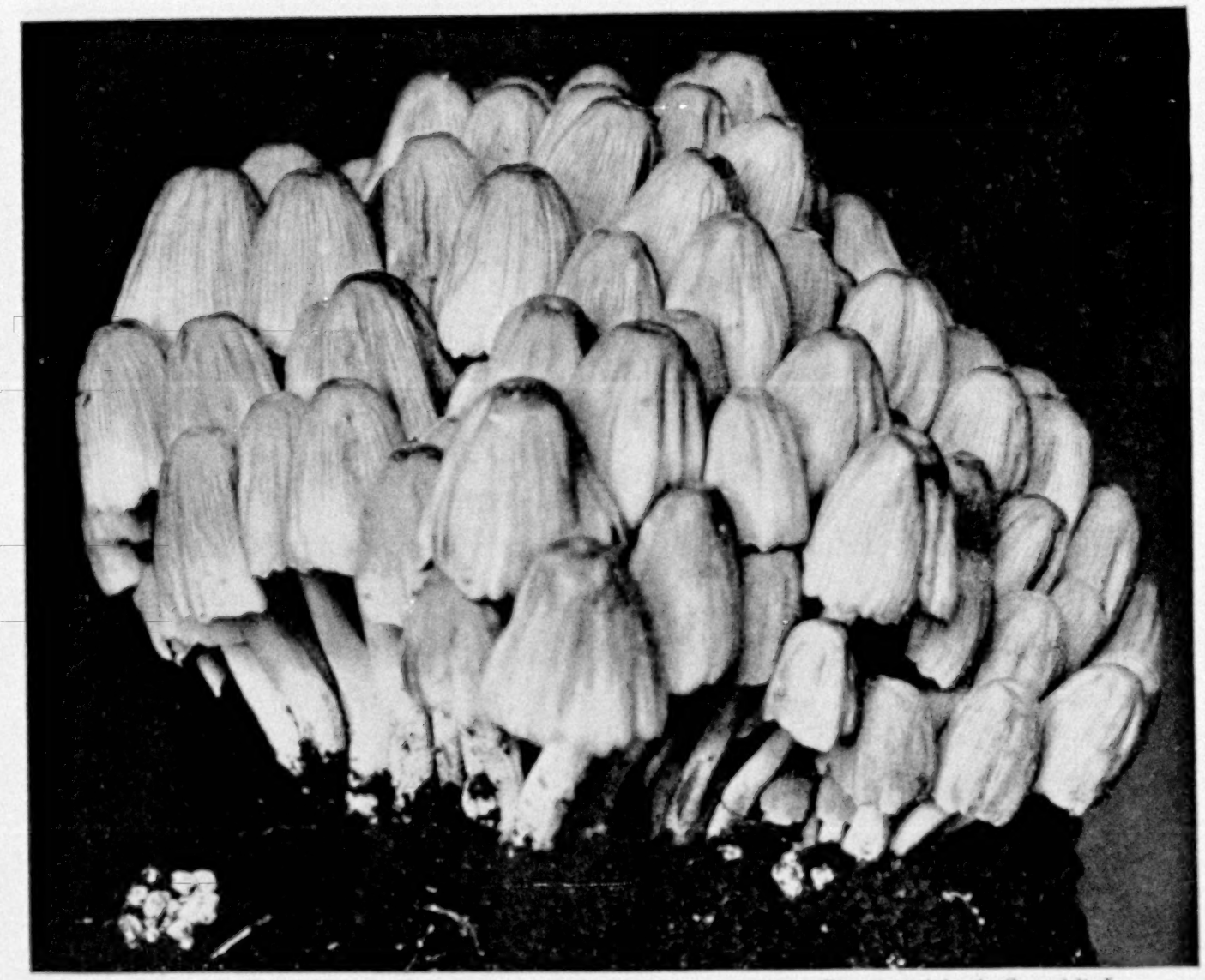
A sight such as this is calculated to make the mushroom-hunter's mouth water. Note that the central, eccentric, or lateral attachment of the stem to the cap is a matter of position of growth; the caps on the side of the log have lateral stems, those on the top central, or very nearly central, ones (see illustration, page 402).

THE JACK-O'LANTERN MUSHROOM, OR FALSE CHANTRELLE (Clitocybe illudens). Poisonous

(See Color Plate III)

To see light emanating from a mushroom is at least a novel experience that is possible if one views perfectly fresh specimens of the Jack-o'-Lantern by night; but this is the limit of its interest for us. As an edible species, it is not to be thought of; for, though pleasant enough to the taste and enjoyed without inconvenience by some, it acts as a powerful emetic with most people. Moreover, recent chemical investigation of the plant has demonstrated the presence of muscarin in its tissues, the same substance that plays such an important rôle in poisoning by *Amanita muscaria* (see text on this page).

Dense clusters of this Clitocybe may often be seen growing on or about old stumps of chestnuts, oaks, and other deciduous trees. Occasionally, such clusters contain hundreds



Photograph by A. G. and B. Leeper

THE GLISTENING COPRINUS (*Coprinus micaceus*). EDIBLE

Soon after the first showers in April this tiny ink-cap emerges from the ground in clusters of hundreds of individuals. The best harvesting implement is a pair of scissors. It grows at the base of old trees, stumps, and from buried wood in lawns. Caps tawny, and glistening with minute, mica-like particles; stems white. About natural size (see figure, lower left, Color Plate VIII).

of individuals. It should be looked for in the autumn.

The caps often measure as much as ten inches across, the stems being proportionately long.

Pleurotus olearius, another phosphorescent mushroom that parasitizes the olive tree in southern Europe and is also poisonous to human beings, is closely related to, if not identical with, this plant.

EDIBLE AND POISONOUS FLESHY TUBE-FUNGI (Various species of Boletus)

(*See Color Plate IV*)

Though similar in shape, the fleshy tube-fungi differ in one important point from the gill-fungi; instead of gills, the under side of the cap exhibits a layer of small, vertically placed tubes, on the inside of which the spores are borne.

The Boleti are fairly safe; yet the beginner ought to be forewarned against certain species that are likely to cause illness when eaten. Chief among these is a group collectively known as the Luridi. The prime distinguishing mark of species belonging to this group is the more or less bright red, orange-red, or maroon coloring of the tube-mouths; also, all Boleti that show the slightest tendency to assume some shade of blue when broken or bruised should be avoided. Bitter species, too, should not be eaten, especially *B. felleus*, a somewhat robust plant with pinkish flesh-colored tubes.

The edible Boletus, the cèpe of commerce (*Boletus edulis*), Plate IV, is the well known and much sought *cèpe* of the French. Before the war, a regular article of commerce, one could purchase it, either dried or canned, at the little delicatessen shop "around the corner." Now we are dependent upon our own supply, which is none too plentiful. In the coast counties of California, however, it seems to be fairly abundant, for the writer has seen Italian

Photograph by Roland McKee

THE INKY COPRINUS (*Coprinus atramentarius* VARIETY). EDIBLE

This variety lacks the fine scales on the top of the cap, which are prominent in the typical form. The very delicate silvery gray luster of the cap vanishes with the slightest touch. The "ink" from this mushroom makes a forgery-proof writing fluid (see page 439). Natural size.

residents there return from collecting trips with their automobiles laden with them.

In preparing it, either for immediate use or for pickling or canning, the layer of tubes and the tough portion of the stems should be removed. When used fresh, the cooking should be rapid over a brisk fire. Frying or broiling with butter or olive oil, with the usual spices added, seems best adapted for this fungus. When pickled, add cloves, bay leaves, and other spices.

Except for the stem, which is at times much shorter, and club- or pestle-shaped, the illustration shows a fully matured plant. When young, the tubes are pale, creamy white, but as the plant develops they become greenish, and when touched or bruised change to a greenish-ocher color, *not to blue*.

The species is extremely variable, both as to shape and color, some specimens showing a brownish-lilac color on both cap and stem. The constant features, however, are the colors and color changes of the tube layer, and the fine mesh of white lines on the stem, usually but not always confined to the upper part.

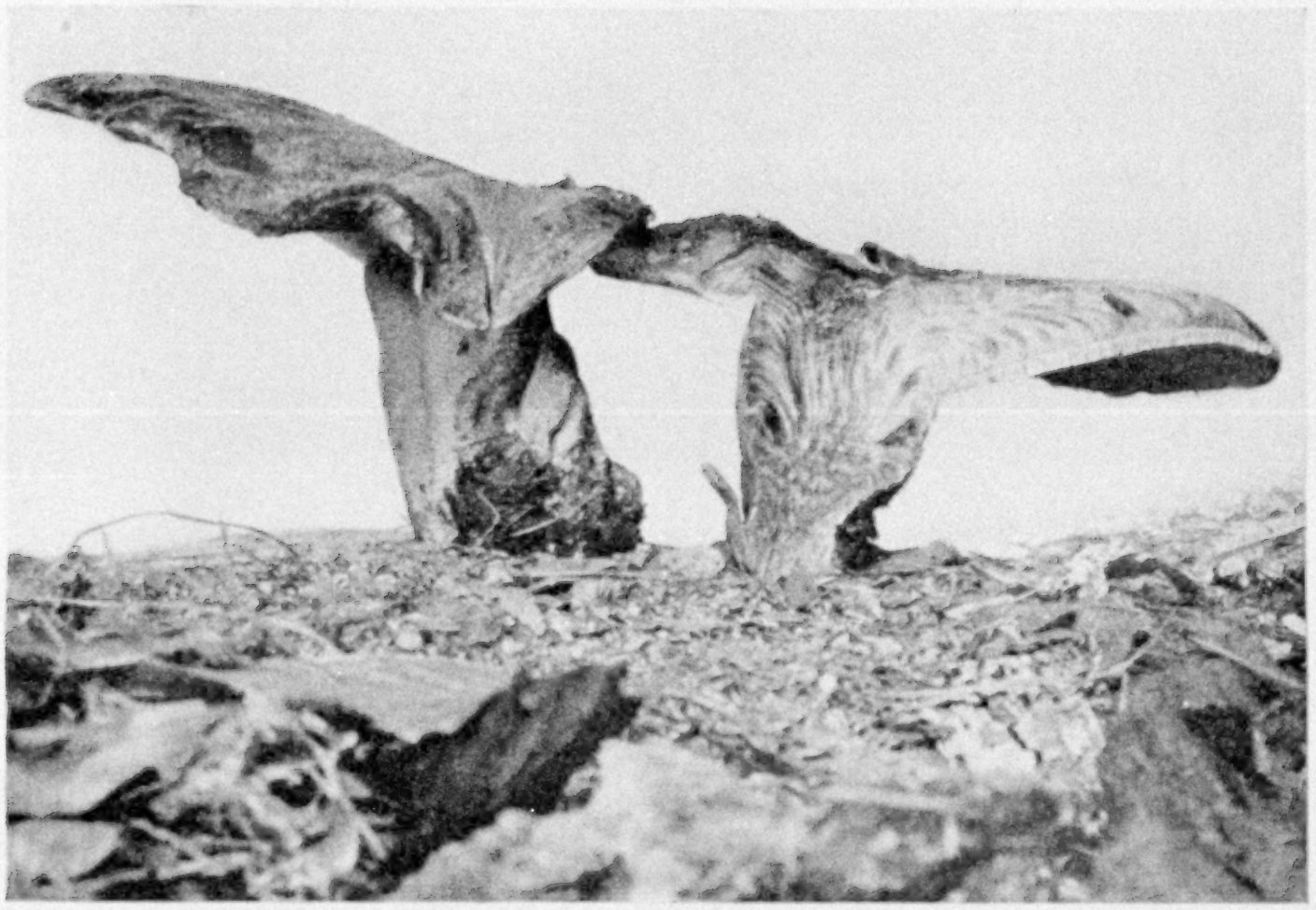
The edible Orange-cap Boletus (*Boletus versipellis*) is much coarser and larger than the cèpe and not so desirable. Still, in the absence of something better, it is eaten by those who must have their mushrooms (see page 406).

It is quite common and easily recognized by the numerous rough, blackish points on the stem and by the overlapping margin of the reddish- or orange-colored cap. Its flesh changes color to a neutral, reddish gray.

Photograph by A. G. and B. Leeper

THE ORANGE-CAP BOLETUS (*Boletus versipellis*). EDIBLE (SEE COLOR PLATE IV FOR ANOTHER SPECIES OF BOLETUS)

A large, coarse, tube- instead of gill-bearing plant with a reddish-orange cap, overlapping margin (of the cap), and rough, black-dotted stem (see text, page 405). Compare the under side of the cap with that of the common mushroom (page 400) and other gill-mushrooms included in this article. In the fleshy tube-fungi, instead of gills (see page 399), the under side of the cap exhibits a layer of small, vertically placed tubes, on the inside of which the spores (see pages 392, 405, and 415) are borne.



Photograph by A. G. and B. Leeper

THE EDIBLE BEEF-TONGUE MUSHROOM (*Fistulina hepatica*)

Cap blood-red, pores (on under side of cap) creamy pink, flesh streaked with red and pink, this fungus grows on chestnut and oak stumps from July to October. The plant is so distinct that it is not easily confounded with other species. The illustration is about one-half natural size.

THE HANDSOME VOLVARIA (Volvaria speciosa). Edibility doubtful

(See Color Plate V)

Opinion as to the edible qualities of the Handsome Volvaria diverges considerably. While some speak of it as "a fine edible agaric," others pronounce it "watery and unpleasant to the taste," or even poisonous. Since the plant is somewhat variable, and therefore not clearly separated, except by spore characters, from the very poisonous *Volvaria gloiocephala*, it is advisable to let it alone.

Only recently Prof. W. C. Coker, of the University of North Carolina, reported a variety of *V. speciosa* from the sand dunes of Smith Island, North Carolina. His plant had spores larger than those of the type and differed in other characters.

In the eastern United States it is of infrequent occurrence, but on the Pacific coast, especially in California, it is so abundant during April and May that one finds it wherever the soil is rich with decaying vegetable matter.

The odor of the fresh plant is repellent, resembling very markedly that of rancid lard.

The Handsome Volvaria is gathered from April to October; distribution, temperate North America, Europe, and North Africa.

CORAL MUSHROOMS (Various species of Clavaria). Edible

(See Color Plate V)

"But that is not a mushroom!" exclaims the tyro, seeing his first Clavaria. "Why, it looks like coral."

It is true that these plants show no differentiation into cap, gills, tubes, or teeth, but they are, nevertheless, true fungi, the spores being borne on the exterior of the branches.

With the exception of a single species, all, so far as known, are good to eat, provided the taste is agreeable and the specimens are fresh and free from insect attack. The exception is a species (*C. dichotoma*) in which the branches are rather thin, flaccid, whitish, and divided regularly into twos.

Clavaria fusiformis (see Color Plate V) is long, bright orange-yellow with a delicate bloom, dark-tipped, and usually grows in tufts. The interior is solid at first, then hollow. Occasionally specimens are found that are variously bent, twisted, or malformed.

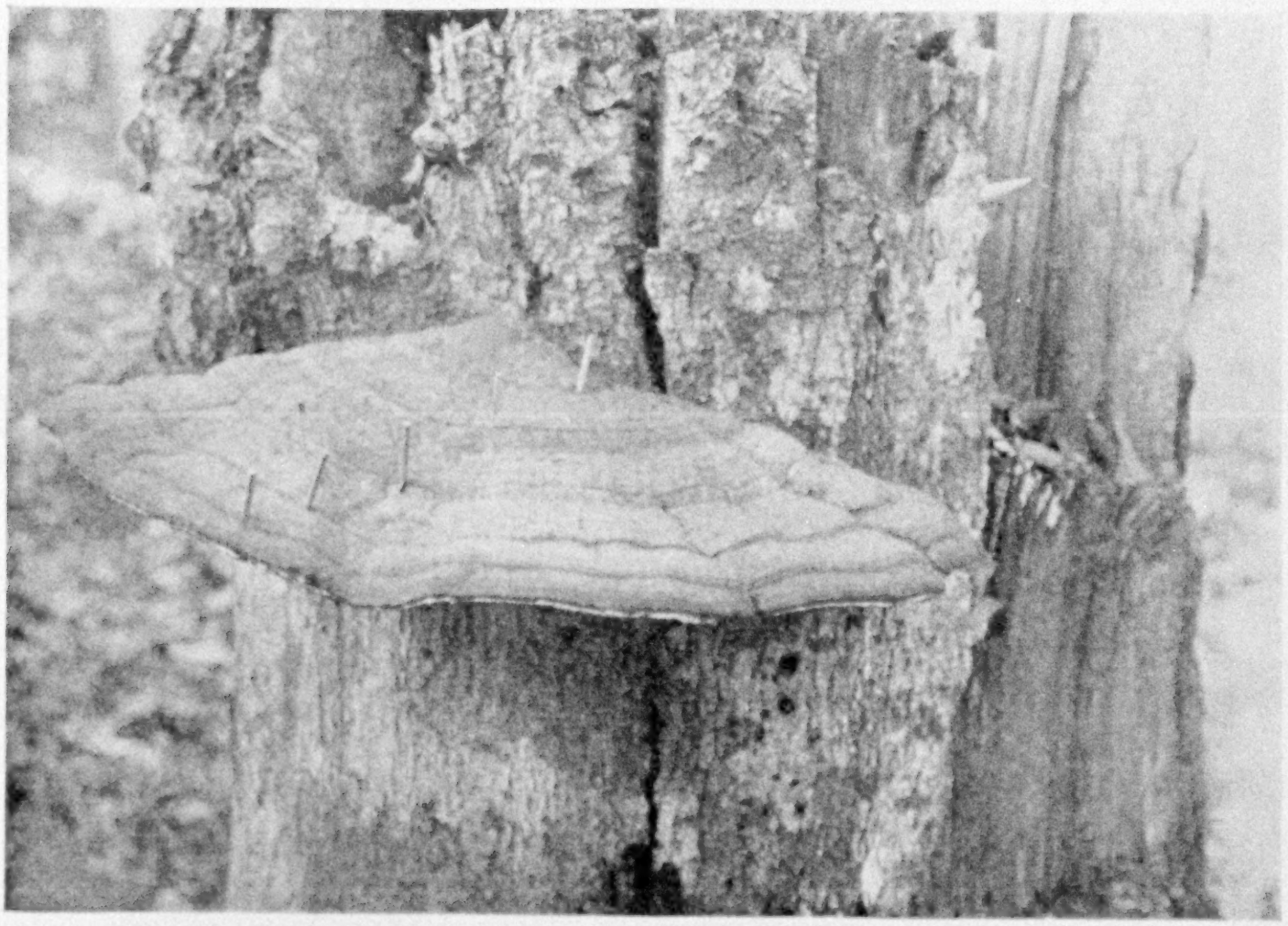
Clavarias may be sought in both deciduous and coniferous woods from July to September (see illustration, page 412).

Other edible species are *Clavaria flava* and *Clavaria botrytes*.

Photograph by A. G. and B. Leeper

THE EDIBLE *Polyporus frondosus*

Dense masses of this tree fungus may be found growing at the base of oaks and other trees. The color of the upper surface of the caps is a sooty-gray; that of the lower, finely porous side, white. The illustration is about one-third natural size.



Photograph by George Shiras, 3d

A BRACKET-FUNGUS (*Polyporus applanatus*)

Note the concentric zones marked with match-sticks. Each zone indicates the limit of a year's growth. The under side of this woody fungus makes an admirable sketching surface. A sharp twig will do for a pencil. The bracket fungus is the fruit-body of a destructive parasite very common in our forests (see page 417). You do not rid the infected tree of its fungus parasite by removing the fruit-bodies. The disease is produced by the mycelium (or spawn) threads, which (more or less compacted into tissues) permeate the wood of the tree. This particular species has a whitish, porous surface, which is easily embrowned on the slightest touch—hence its use as a sketching surface.

THE DEADLY AMANITA, OR DESTROYING ANGEL (Amanita phalloides and its varieties). Deadly poisonous!

(*See Color Plates V, X, and XVI*)

"Do not eat mushrooms and you will not be killed by them."

If every one followed this injunction, further advice would be superfluous. That it is not universally followed is certain, for each year brings new records of poisoning cases, most of which are caused by species of Amanita. The first duty of those who insist on eating mushrooms is, therefore, to become thoroughly familiar with the botanical features of this genus. These once impressed upon the mind, the danger from Amanita poisoning will be much reduced if not entirely eliminated.

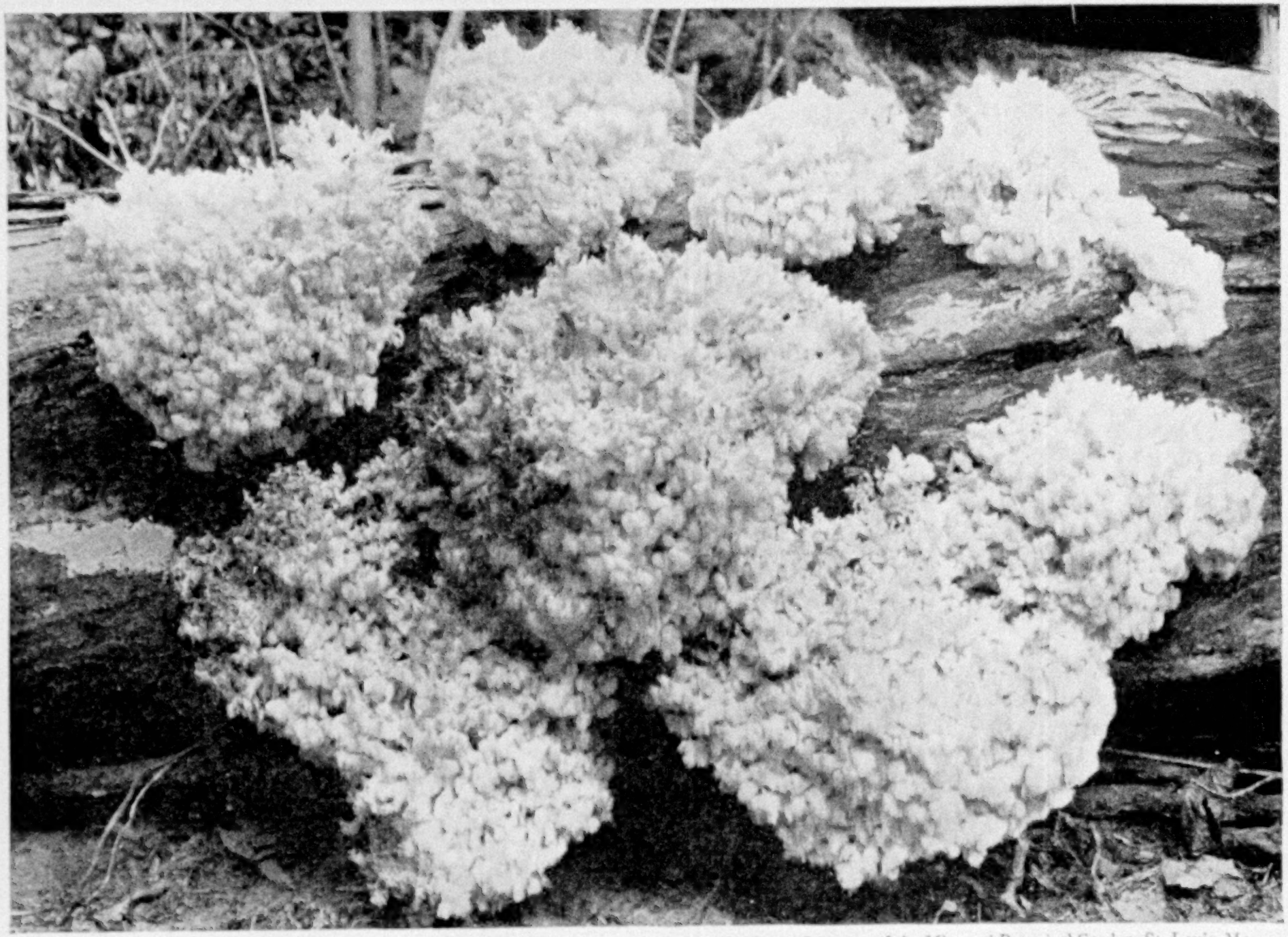
The following characterization of Amanitas should be memorized by the beginner as he would memorize a theorem in geometry:

Any white-spored, more or less free-gilled fungus that possesses both ring and volva is a member of the very dangerous genus Amanita (see chart, page 389).

Extremely common in all parts of the country from June until the first frosts, the deadly Amanita grows singly or scattered, in and near both deciduous and coniferous woods, in the soil, among leaves, particularly where the ground is low, wet, and not too sandy; also in places where woods have recently been cut down, such as lawns, pastures, and fields in new suburbs.

The symptoms of poisoning from this fungus appear much later than those due to *Amanita muscaria*. The unfortunate victim remains quite well until seized suddenly with violent abdominal pain, in from six to fifteen hours after eating the fungi. Excessive vomiting, thirst, and either diarrhea or constipation accompany the abdominal pain.

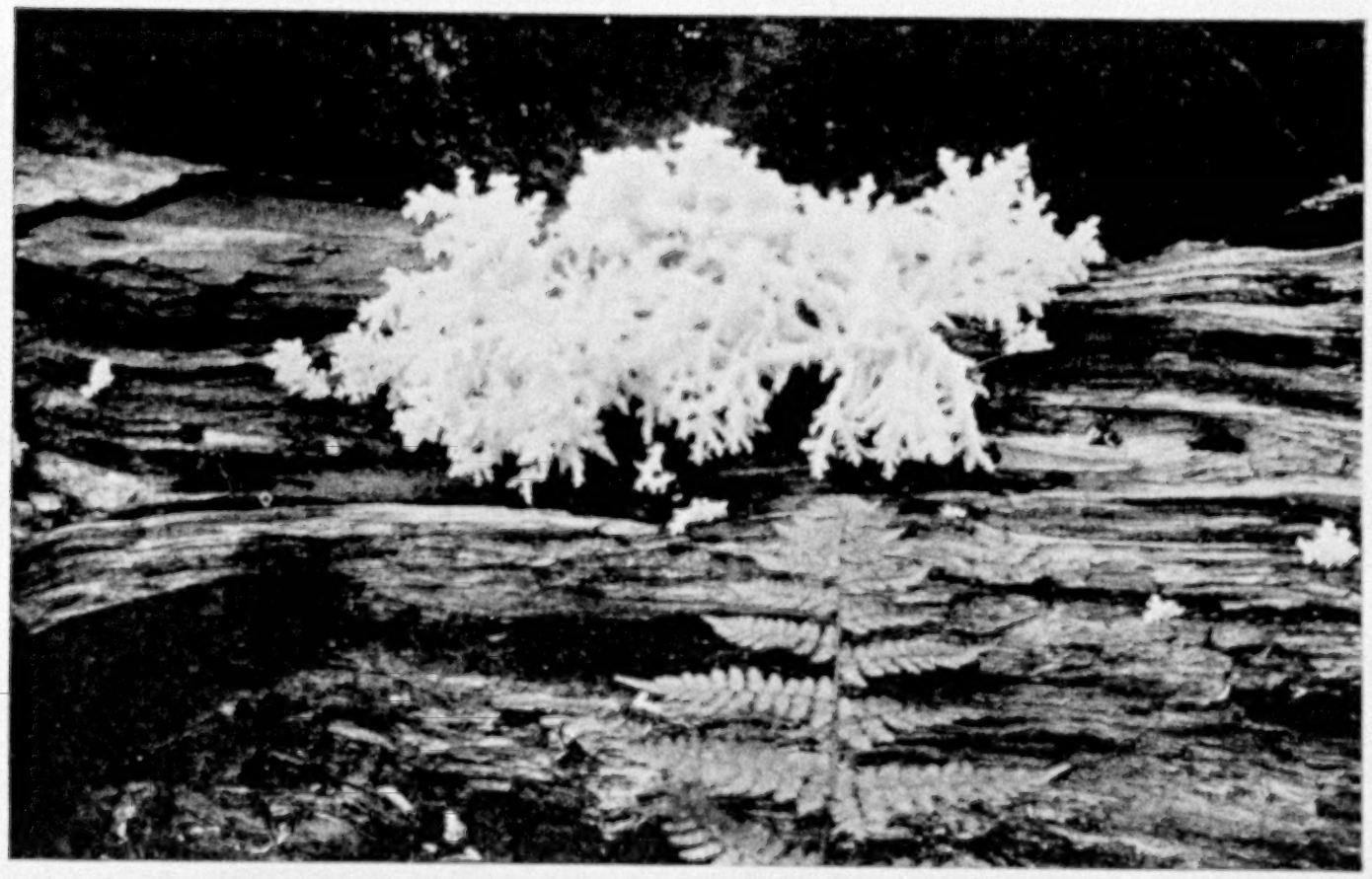
The paroxysms of pain may be so severe that the face becomes drawn, pinched, and of a livid color (Hippocratic face). The attacks of pain and vomiting come on periodically, the patient loses strength rapidly, jaundice frequently sets in, and coma finally develops, fol-



Courtesy of Dr. George T. Moore, Director of the Missouri Botanical Garden, St. Louis, Mo.

THIS EXQUISITE CORAL HYDNUM (*Hydnum coralloides*) IS EDIBLE

It is said that the illustrious Swedish botanist, Elias Fries, was attracted to the study of fungi on beholding a specimen of this species growing in a forest of his homeland. Size: Individual clumps up to 10 inches.



Photograph by George Shiras, 3d

AN UNUSUALLY BEAUTIFUL CORAL MUSHROOM (*Hydnum laciniatum*) GROWING ON A PROSTRATE TREE

The species is closely related to *H. coralloides*, shown on page 410. It is edible when white and fresh. Size: Individual clumps up to 10 inches.

lowed by death. Convulsions may or may not occur toward the end.

The duration of the illness is from three to eight days, depending upon the age of the patient and upon the amount of fungus eaten. There is no known antidote for the poisons, and the death-rate is, therefore, very high, ranging from 60 to 100 per cent.

A description of *Amanita phalloides* and its varieties: Cap 2 to 6 inches broad, fleshy, at first egg-shaped to bell-shaped, then obtusely convex, finally plane or depressed (concave when old and overexpanded), usually a little elevated in the center, but not umbonate, white (in the spring form, *A. verna*, and in *A. virosa*, the latter illustrated in Plate X), light yellowish-white, dull yellow or light brown, grayish, grayish-brown or olive-brown (livid purplish-brown in *A. porphyria*), the disk frequently darker in some individuals, approaching black (see Plate XVI), citron-yellow (*A. citrina*, illustrated by the figure on the extreme right in Plate V), greenish yellow, green or olive-green, occasionally streaked with darker shades of the prevailing color or with dull reds.

THE HONEY-COLORED MUSHROOM, OR OAK FUNGUS (Armillaria mellea). Edible

(*Upper figure, Color Plate VI*)

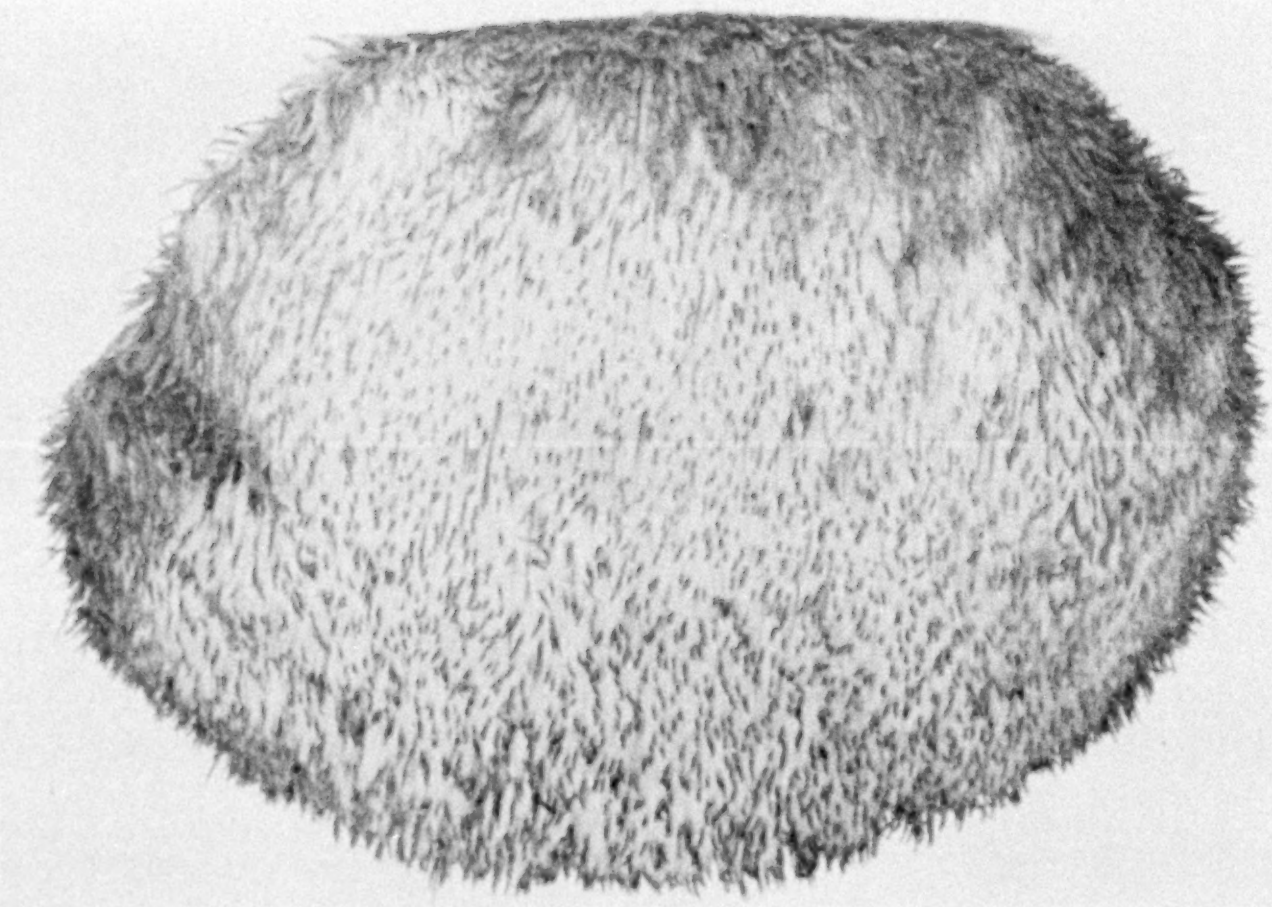
Tête de Méduse is a French common name for this agaric, the appearance of which in an orchard is as much feared by the owner of the trees as was the Gorgon head of old.

Its appetite for living, ligneous substance is truly astounding. With equal zest it feeds upon oaks, chestnuts, pines, larches, hemlocks, and white cedars, reserving for dessert the grapevine and most fruit trees. When times are hard and "pickins' slim," it turns upon the humble potato. Once, so far as we know, its attack was met, and this by an orchid. After a battle for supremacy, the two finally came to an understanding and decided to work together for their mutual benefit.

Like most successful organisms, it has a great capacity for adapting itself. Equally at home on plains, mountain peaks, and in mines, it pursues its prey relentlessly, its rapid propagation being aided by blackish cords (rhizomorphs) that do reconnoitering duty under the ground and under the bark of trees. Even the orchardist plowing over the site of a tree killed by the Armillaria unwittingly assists in its distribution by scattering fragments of these rhizomorphs over new feeding ground.

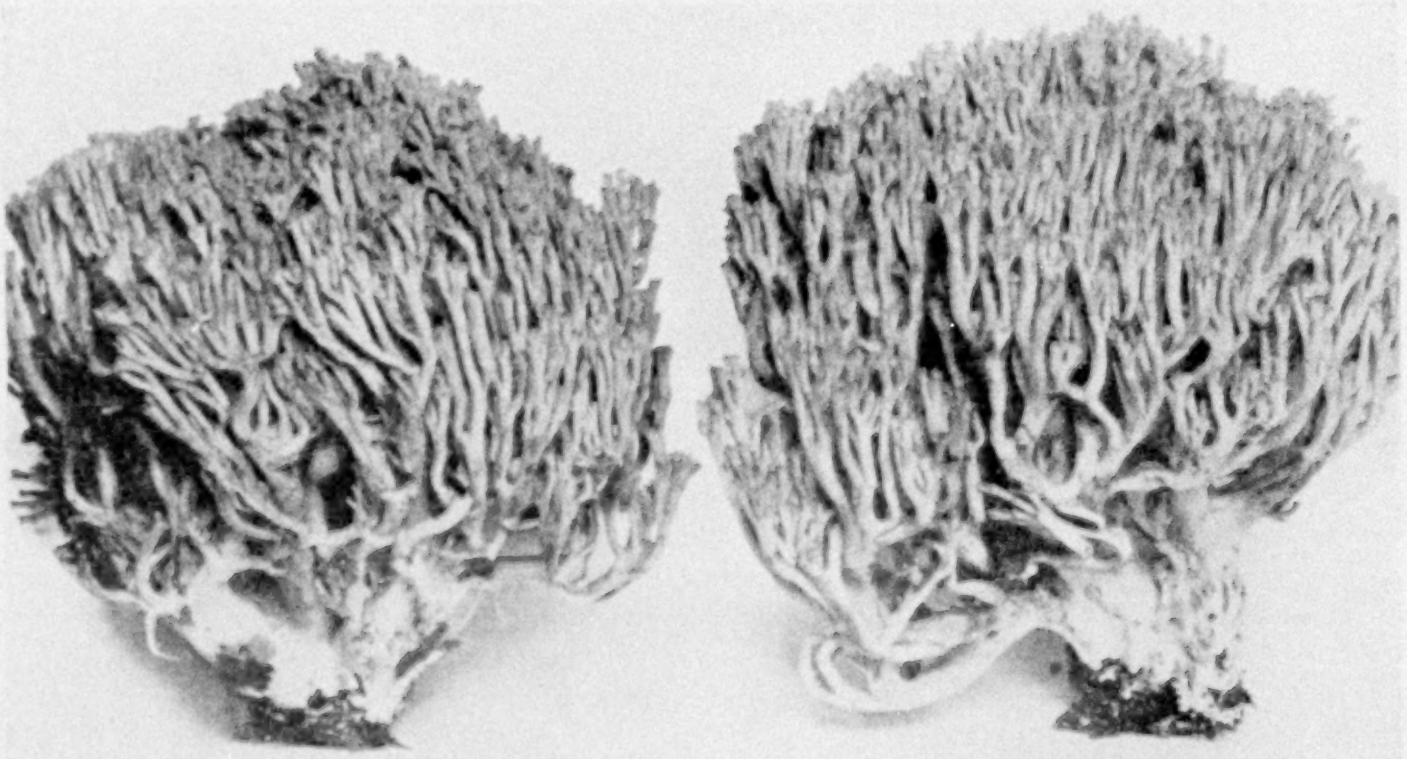
Much work has been done to combat this fungus pest, latest among which is that by Prof. W. T. Horne, of the University of California.

As might be expected in so widely distributed and adaptable a plant, its tendency to vary, both in color and in structure, is almost limitless (see pages 394 and 395).



THE HEDGEHOG HYDNUM (*Hydnum erinaceus*). EDIBLE

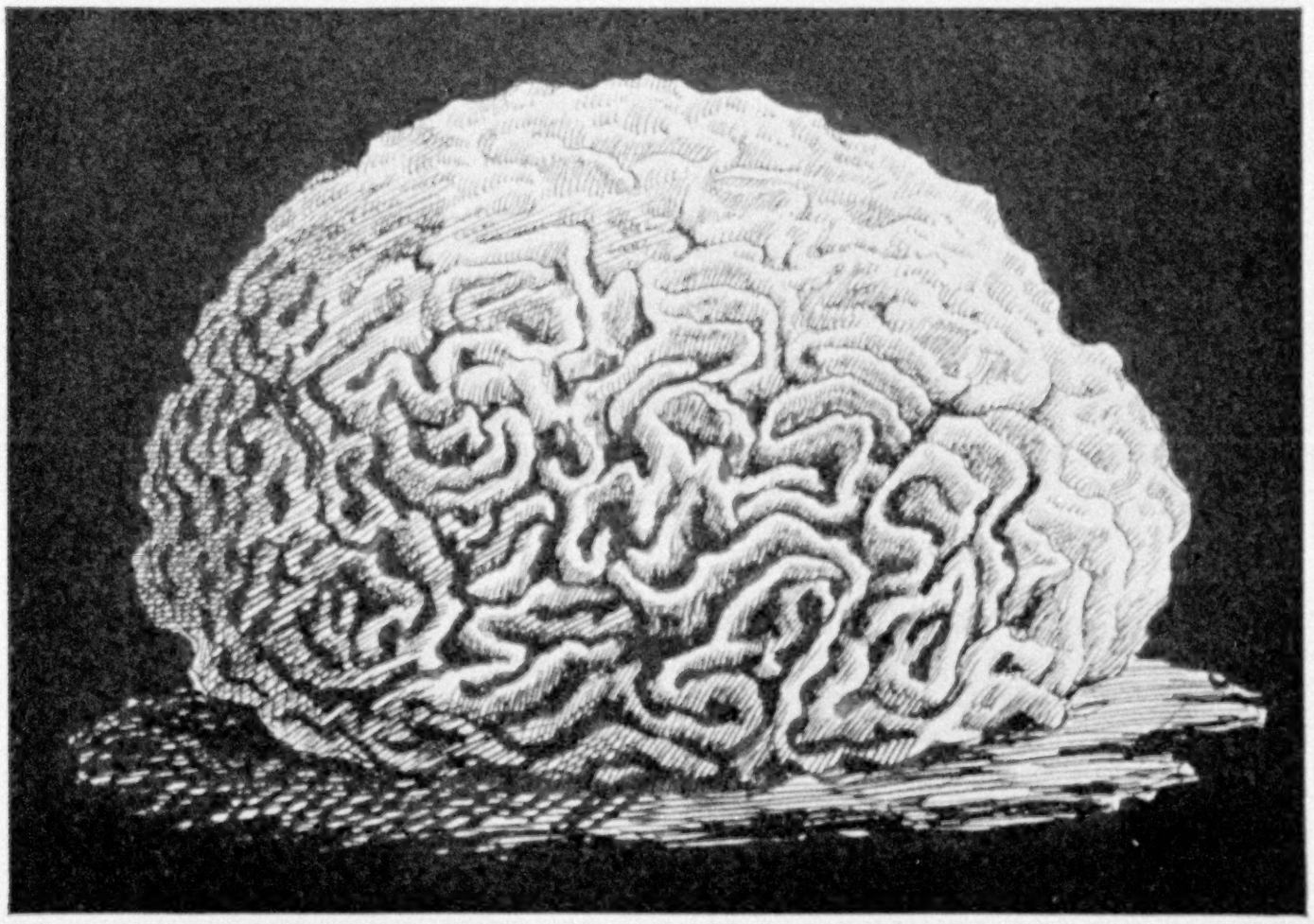
Not infrequently the assiduous mushroom-hunter, "new to the game," finds specimens that do not tally with his conception of what a mushroom should be like. This is one of those surprises. Whitish to creamy-white when fresh. Somewhat under natural size.



Photographs by A. G. and B. Leeper

A CORAL MUSHROOM (*Clavaria flava*). EDIBLE

The novice seeing this remarkable growth for the first time finds it difficult to believe that it is a mushroom. Branches pale yellow; base and main stems white. Common in woods from July to September. Somewhat under natural size. (For another Clavaria, see Color Plate V, middle figure.)



A HUGE, CONSPICUOUS MUSHROOM SOMETIMES FOUND IN FORESTS (*Sparassis herbstii*). EDIBLE

This rare and beautiful fungus should be looked for in oak woods. About one-half natural size.

Because of the acrid taste that is usually present in the raw plant, it is not rated very high as an edible species.

This mushroom grows wherever there is wood to be attacked in the open, commonly in woods, on the ground, or on decaying stumps and trunks of trees, singly, scattered, or in dense clusters; time, mainly in the autumn, though it may occur as early as June; distribution, cosmopolitan.

THE GARLIC MUSHROOM (Marasmius scorodonius). Edible

(*See Color Plate VI*)

Some people enjoy the flavor of garlic. To these it will be interesting news that they may have their garlic in mushroom form if they will enter a pine or spruce forest. Here, in vast hordes, covering the fallen twigs, sticks, and needles, grows the little Marasmius. One cannot mistake the plant, for the odor is so pronounced that the "nose knows" it before the eye sees it.

It may be used like garlic, in dressings, and as a flavor for roasts, etc. Since it occurs in great abundance and dries readily, it can be stored for use in the winter, when it will also prove a reminder of the pleasant days spent in mushroom-hunting. The dried plants must be steeped in water before they are employed in the kitchen.

The Garlic mushroom grows in woods, especially of pines, on needles, twigs, etc.; time, July to October, very plentiful after heavy rains; distribution, temperate North America and Europe; also in Siberia.

THE LITTLE WHEEL MUSHROOM (Marasmius rotula). Edible

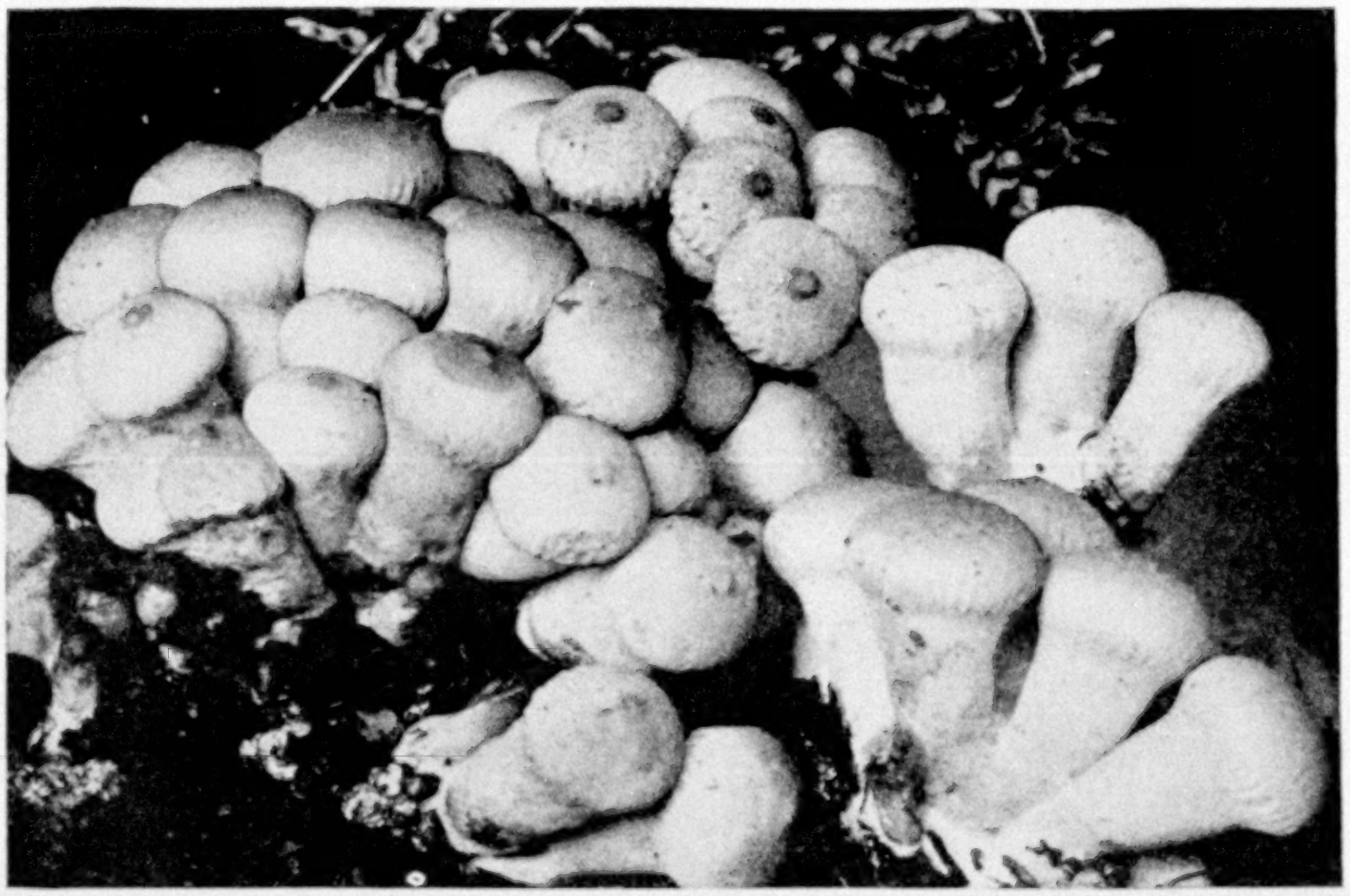
(*See Color Plate VI*)

After a summer shower it pays to scrutinize closely the decaying débris of a near-by wood. Almost certainly one will see on bark, roots, and old leaves tufts of this delicate and marvelously made little agaric.

Note particularly the manner in which the hair-like stem is set into the tiny socket, the sparsity of the gill development, and the fine furrows and scallopings of the margin of the cap. A Swiss watchmaker could not excel such workmanship.

During dry weather the plants shrivel into invisibility, but, like all members of the genus Marasmius, they regain their pristine freshness with the return of rain. Sometimes, as if fatigued from the production of so much minute workmanship, the plants fail to produce caps, and the stems, too, are often abnormally grown together in a branching manner.

For culinary purposes this species is used as an addition to gravies. When garnishing veni-



Photograph by A. G. and R. Leeper

THE GEMMED PUFF-BALL (*Lycoperdon gemmatum*) FOUND EVERYWHERE

Though small, this "gem-studded" species is much sought by mushroom-eaters and may be discovered growing scattered or in tufts, usually on the ground. About one-half natural size.

son, it adds the appropriate touch of the wild woodlands.

This species grows on decaying wood (bark, roots, and stumps) and on old leaves in woods of maple, beech, etc.; time, June to September; distribution, temperate North America, Europe, and South Africa.

HEDGEHOG MUSHROOMS (Various species of Hydnum)

(See Color Plate VI)

Not infrequently the assiduous mushroom-hunter, "new to the game," finds specimens that do not tally at all with his conception of what a mushroom should be like. He has soon learned, of course, to recognize the gill tribes (see page 390), and the Boleti (see page 406), and perhaps the Clavarias (see page 412), but should he encounter a toadstool with "teeth," he will be nonplussed, until assured by his mycological mentor that there are such "animals," and that they go by the name of Hedgehog mushrooms.

They are not as frequent as the others, and therefore all the more of a surprise when met with. Some are conspicuously beautiful, and the story that the great Swedish mycologist, Elias Fries, was attracted to the study of the fungi on beholding in his youth a specimen of the snowy-white coral Hydnum may well be believed (see illustration, page 410).

The teeth, varying in size and color in different species, clothe the lower side of the fruit-bodies, which may be cap-like, as in agarics and boleti, branched, solidly formed into tuberous, fleshy masses, or spread out in a flat layer. No poisonous species are known, though many are tough, bitter, or malodorous, and thus naturally unattractive to the mycophagist.

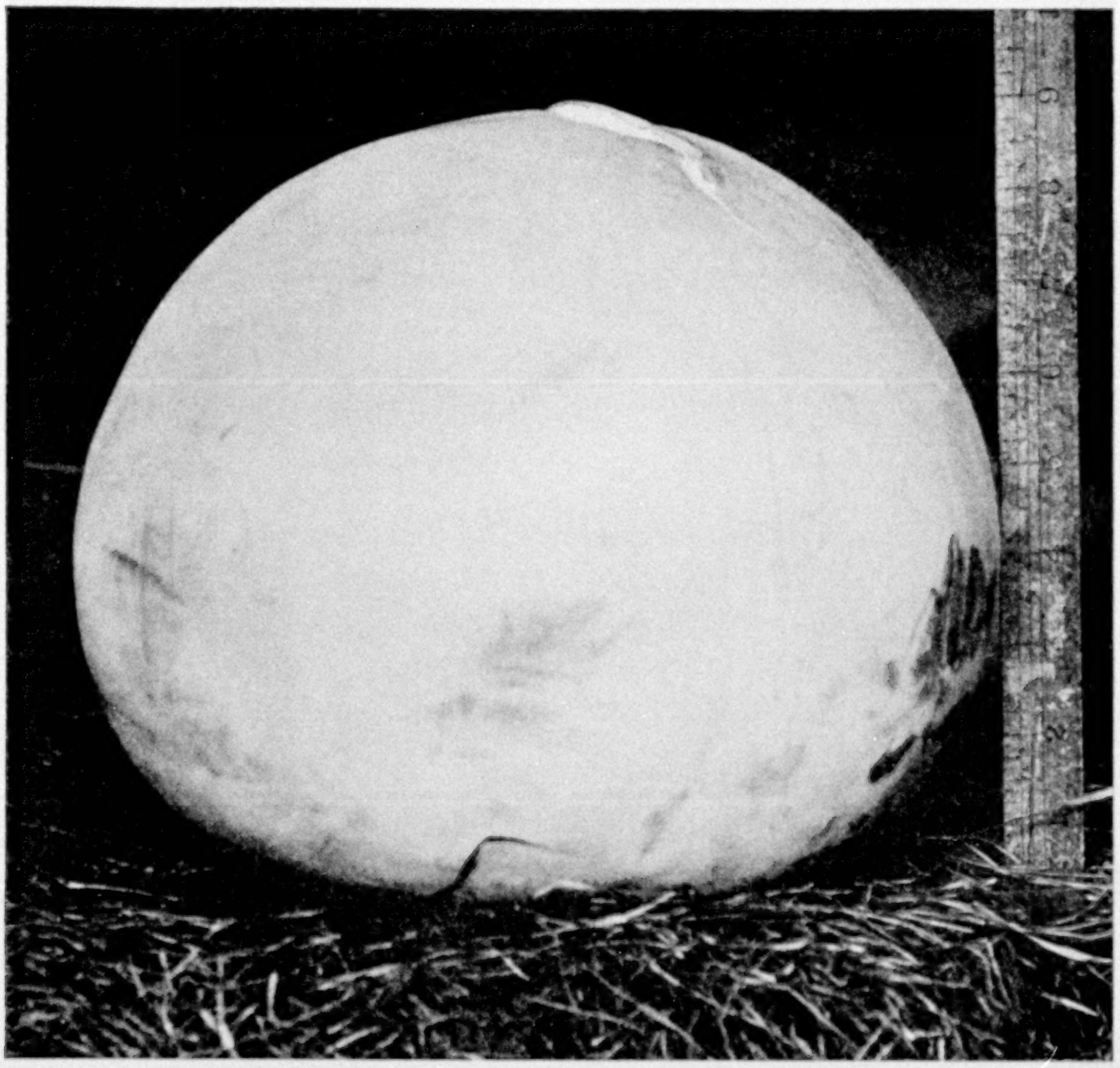
Hydnum fennicum, the Finnish Hydnum (see Color Plate VI), is too bitter to be eaten, but its general aspect gives some idea of the appearance of the edible *H. imbricatum*. The latter species has a more umber-colored, less reddish cap, no blue discoloration in the flesh of the stem, a less bitterish taste, and coarser teeth. Deer are said to be fond of it.

THE CINNAMON CORTINARIUS (Cortinarius cinnamomeus). Edible

(See Color Plate VII)

Plants belonging to the bulky genus *Cortinarius* are very numerous in our forests during the autumn months; yet, except for a few well-characterized species, one and all are left severely alone by the average student of mushrooms; this not because of any fear from poisoning—the genus is a fairly safe one—but because of the difficulties attending their study.

It is easy enough to say that one has found a "Cort"—the term of endearment for members of this "offish" genus. To determine the plant



Photograph by A. G. and B. Leeper

THE GIANT PUFF-BALL (*Calvatia gigantea*)

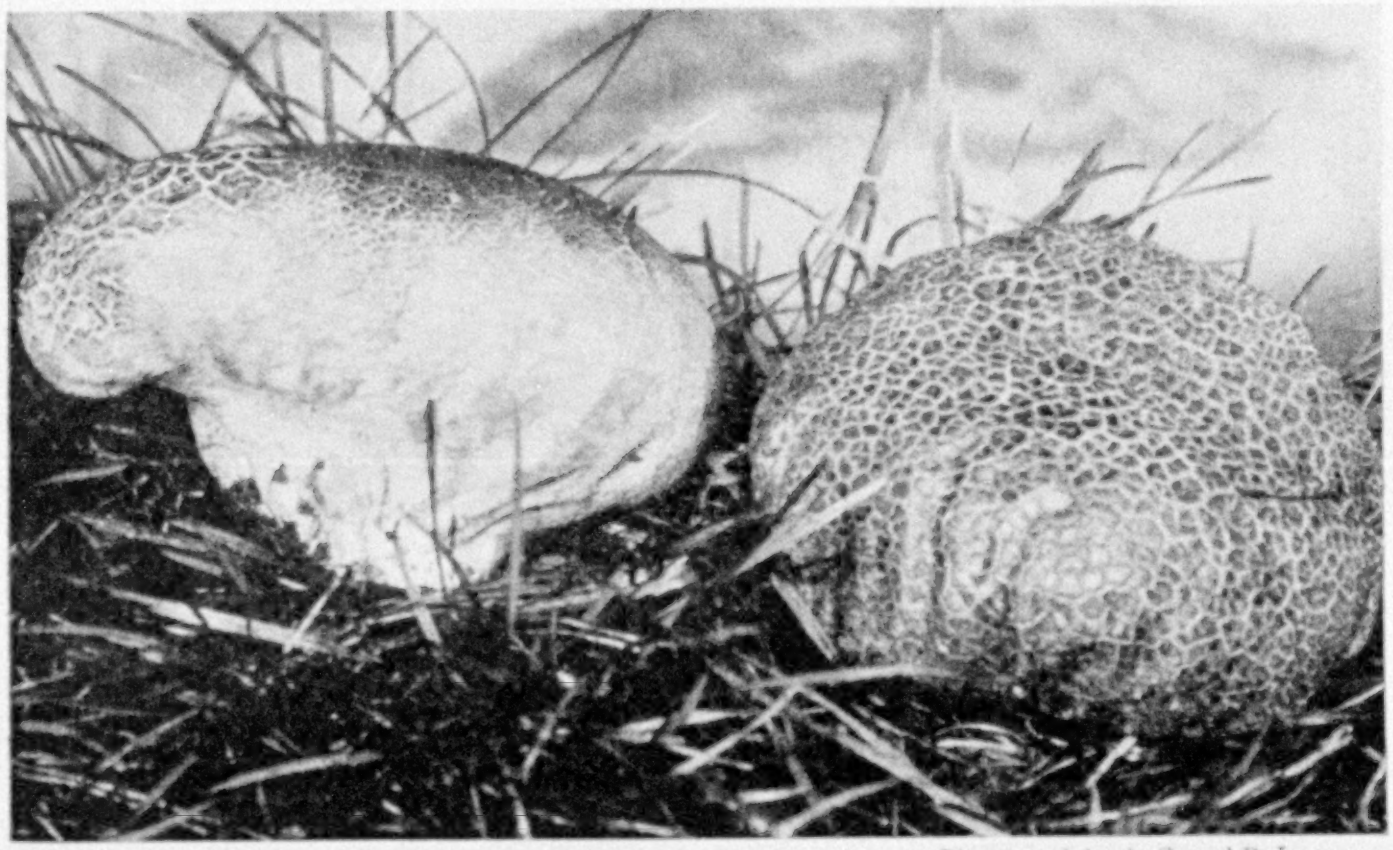
The best-known of all puff-balls. A single specimen will suffice for the largest family. Diameter often fourteen inches and over.

As children, we have all squeezed the puff-ball to make it "puff," little realizing that in doing this we were liberating billions of spores, which—if everything went well with them—would produce in turn billions of puff-balls. But there is "many a slip" in the life of a puff-ball spore. Were this not so, the whole country at the proper season, would be paved with puff-balls.

A recent investigator, Professor Buller, computing the number of spores in a single good-sized specimen of the giant puff-ball, found that it contained about seven trillions (7,000,000,000,000); and yet this species is by no means as common as those who know its delicious flavor would like it to be. One is inclined to ask—as we do about the fate of pins—what becomes of them all? . . . The plant grows in grassy places, in August and September, sometimes in "fairy-rings." It is not very common, we regret to say.

To escape acceptance of the theory of the spontaneous generation of life, it has been suggested that extraordinarily minute organisms (bacteria, for example), or their spores, propelled alive through space, might be capable of carrying life to planets. When it is considered that the vitality of some spores remains unimpaired after prolonged exposure to liquid air and even liquid hydrogen, the suggestion seems plausible.

See also pages 392 and 402.



Photograph by A. G. and B. Leeper

THE CUP-SHAPED PUFF-BALL (*Calvatia cyathiformis*) COMMON IN FIELDS

The purplish-brown surface, cracked like an alligator's skin, is the distinguishing feature of this much-hunted species, which grows in pastures and in cultivated lands during August and September. Less than one-half natural size.

specifically, however, is a different problem, largely for the reason that it is essential to have more than one specimen, preferably a whole series, covering the development from extreme youth to full maturity.

If such a series is at one's disposal, important notes can be made—first, on the difference in the gill-color of young and old specimens; second, on the color of the cobweb-like veil, present in all true Cortinarii, and on the presence or absence of a secondary or universal veil; third, on the shape, color, and general surface characters (including degree of stickiness) of the plants.

The species included here and figured in its natural colors is sometimes found. The change in the color of the gills is shown, as is also the difference in the general aspect due to growth. The amateur would scarcely consider the two plants as belonging to one species. To complicate the situation further, this species has several varieties, one of which, with blood-red gills, is quite common.

Many species of *Cortinarius* exhibit beautiful coloration, the light lavender, blue, and violet-colored ones being noted in this respect. A few have bright red bands encircling their stems, as in the common *C. armillatus*.

THE CHANTRELLE (Cantharellus cibarius). Edible

(*See Color Plate VII*)

On special state occasions the golden Chantrelle graces the festive board, yet there is no reason in the world why it should not be on every man's table throughout the land and throughout the year. Abundant and easily recognized, any one may gather it in quantity and without fear of being poisoned.

Its natural habitat is in forests of spruce, pine, hemlock, beech, and other trees; commonly found growing in troops, from June to October. Long cooking over a slow fire, in a covered vessel, improves both flavor and consistency. The dressing may be simple or very elaborate. It dries readily.

Though a somewhat variable fungus, both as to shape and color, its characteristic, dull-edged, irregularly forked gills render identification easy.

It is a cosmopolitan species, but limited, as are most fleshy fungi, to the more temperate regions of the earth (see *Clitocybe illudens*, the False Chantrelle, Plate III).

THE PERENNIAL POLYSTICTUS (Polystictus perennis)

(*See Color Plate VII*)

When in the woods, "stalking" the edible fungi, the hunter, sensitive to the beautiful as well as the useful, cannot but stop to admire the little cinnamon-colored cups of various Polystictus species that stud his pathway. The present species is one of the commonest. A West African species, the magnificent *Polystictus sacer* is an object of religious worship with the natives. Let us hope that it is merely a worship at the shrine of beauty.

The genus *Polystictus* is a member of a large family, the Polyporaceæ. Some of the bracket- or hoof-shaped species of the polypores are familiar objects to the forest rambler. Unfortunately, they are only too familiar to the forester, many being very destructive to our trees. *Polyporus applanatus*, a common bracket fungus, deserves notice because of the use to which it is put by the collector who combines artistic proclivities with his mycologic ones. The under, or hymenial, surface of this fungus is almost white. Upon the slightest scratch, however, the white is removed and a dark line appears.

Provided with nothing more than a good fresh specimen of this fungus and a stylus in the form of a sharp-pointed branchlet, conveniently picked up at his feet, the artist-mycologist may proceed to sketch the landscape. If he has the ability of a Seymour Hayden or a Pennell, the result will compare favorably with a good etching. After the fungus is thoroughly dry, the picture is permanently fixed, and it may then be set up in the summer bungalow to recall a day pleasantly and profitably spent (see page 409 for illustration of *P. applanatus*).

THE EQUESTRIAN TRICHOLOMA (Tricholoma equestre). Edible

(*Lower left figure, Color Plate VII*)

The Tricholomata are attractive agarics. Clean, trim, often of elegant stature and beautiful coloring, they have become known in some countries under the attractive name of Knightly mushrooms. The time for their appearance is rather late in the autumn, when the air is a little chill and the forest foliage is beginning to glow with Titian's tints.

The present species, the Equestrian tricholoma, is one of the better-known examples of the genus. It is edible and therefore eagerly sought as soon as the weather is propitious. The taste is apt to be a little unpleasant in uncooked plants, but this is true of a number of edible species, notably of *Armillaria mellea* (Plate VI) and of *Lactarius piperatus*, a very large, coarse, white, "milk"-exuding species, common in woods. Conversely, some of the deadliest species of Amanita give no forewarning at all through the sense of taste.

The Equestrian tricholoma is found in pine woods; time, September to November; distribution, North America and Europe.

MORELS. (Edible)

(*See Color Plate VII*)

The Morel, or Sponge mushroom, belongs with the Ascomycetes, fungi quite distinct from those which bear gills, tubes, teeth, etc. Not only is there a marked departure in the external form, but the microscopic features, likewise, show a fundamental difference (see pages 420-421).

The normal time for Morels to appear is in spring, though they have been known to occur in autumn. After a gentle April shower, the fungus-hunter, betaking himself to the nearest apple or peach orchard, or to recently burnt-over wooded areas, searches for the light brownish, fawn-colored, or olive gray, pitted heads. If luck is with him he doesn't search long, for he soon finds enough of the coveted 'sponges" to give him his first taste of fresh mushrooms of the year.

For centuries the Morels have been favorites with the fungus-epicures. Indeed, so highly were they regarded by some European peoples that forests were burned down by them to obtain the substratum best suited to their development—a method of procedure that recalls Ho-ti's way of roasting pigs. In recent years efforts have been made by French investigators to grow the plants artificially.

Before proceeding to cook them, the plants should be washed to remove any earth that may be lodged in the pits of the cap. Then, cutting off as little of the stems as possible, the hollow interior must be thoroughly rinsed with hot water. Having further assured one's self that the plants are perfectly fresh, crisp, and clean, cooking can begin.

The methods of preparation for the table are various. Stuffed with veal, chicken, or anchovies, and garnished as elaborately as one pleases, they are especially delicious. But they lend themselves to any mode of cooking. Pennsylvania farmers, who know them as "Merkels," prefer them in a pot-pie.

Different species have been distinguished, but they are one and all edible when in first-class condition. Some, like *M. esculenta* (Color Plate VII), have a more or less rounded cap; others are conical in shape (*M. conica*, page 420), and one, which is said to be better than the rest, has a somewhat oblong, cylindrical, olive-gray cap, which is often a little curved (*M. deliciosa*, page 420). The species *M. semilibera* is shown in the illustration on page 421.

THE DELICIOUS, OR ORANGE-MILK, LACTAR (Lactarius deliciosus). Edible

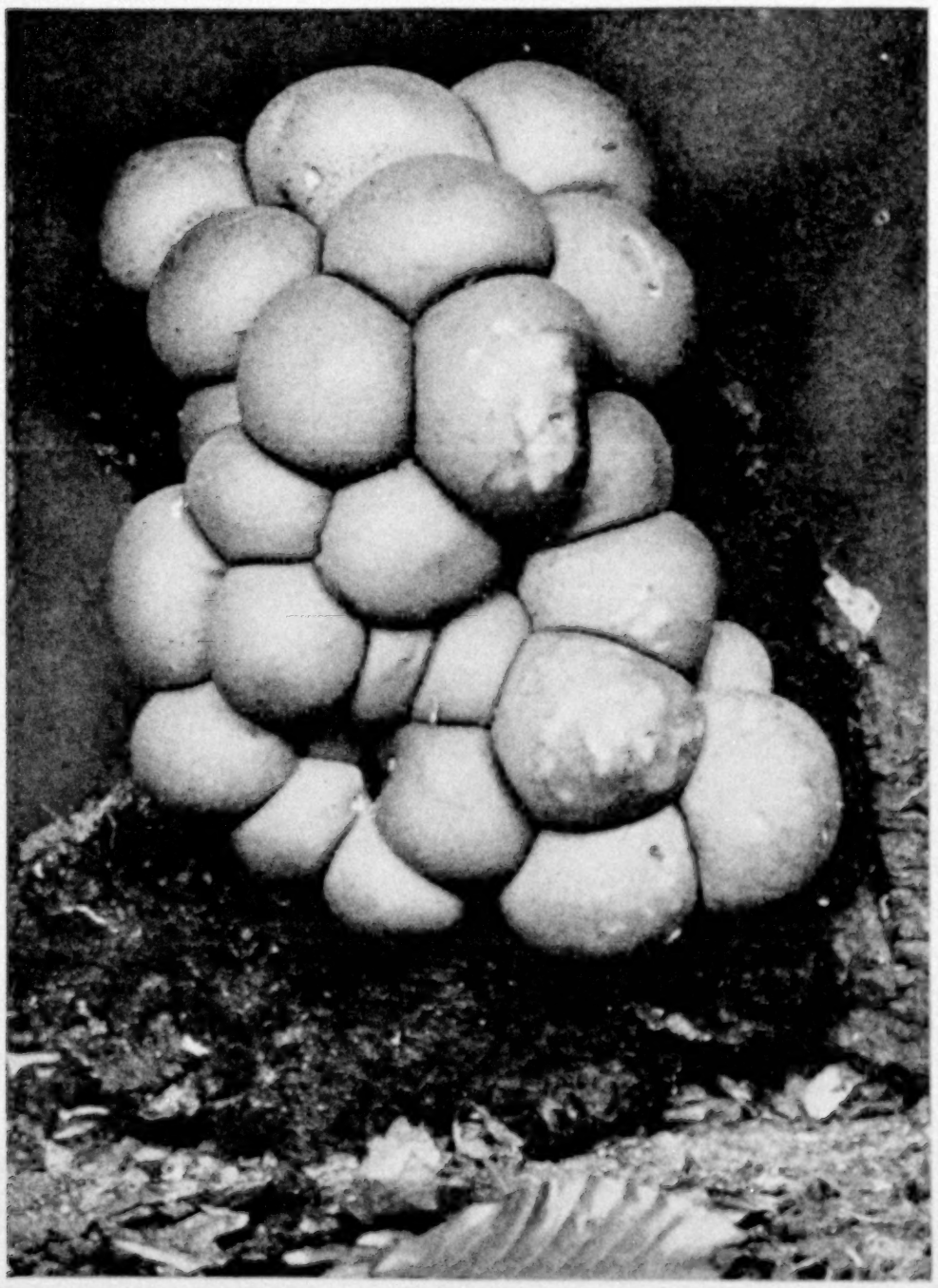
(*See Color Plate VII*)

When injured, certain fungi have the peculiarity of exuding a colored, uncolored, or color-changing juice, called "milk," or latex. Among the larger gill-fungi that have this property are the members of the genus Lactarius.

Of the numerous edible species, the Orange-Milk Lactar—so named because of its orange-colored milk—is the most generally known, its reputation extending back to the old herbalists of the sixteenth century, and possibly to ancient Roman days, for a picture of this species, said to be the earliest representation of a fungus extant, was discovered on a wall in ill-fated Pompeii.

The following quotations will convey some idea of the esteem in which it was and is still held.

Sowerby says: "It is very luscious eating, full of rich gravy, with a little of the flavour of mussels." Sir James Smith pronounces it "the most delicious mushroom known." Other



Photograph by A. G. and B. Lecper

THE PEAR-SHAPED PUFF-BALL (*Lycoperdon piriforme*)

This small, edible species may be found on almost any rotting stump or log from July to late in the autumn. Natural size or a little under (see also picture on opposite page).

commendatory comments are: "Good, preserved in vinegar" (Richon and Rozé); "Most excellent" (Berkeley); "Fried with butter and salt, it has a taste like lamb" (De Seynes).

Dr. Peck, our own more recent authority, says, it is "one of our most valuable mushrooms, but scarcely equal to the best. Doubtless differences of opinion concerning it may be due in part to different methods in cooking."

With regard to tastes, it is always well to remember that they are individual; "otherwise moths would not eat cloth."

When eaten in the raw state, the Orange-Milk Lactar develops an acrid taste, and when old its bright-orange coloring changes to dull, grayish-greenish, unattractive hues. It is, therefore, inadvisable to eat uncooked or old specimens. Pickled in vinegar, however, it is very appetizing when served as a relish with cold meats.

This desirable species is found in moist, mossy woods of pine, tamarack, hemlock, etc.; time, July to October; distribution, North America and Europe.

PANÆOLUS Species
Poisonous

(*See Color Plate VIII*)

Every collector of edible species should learn to distinguish the Panæoli from *Agaricus campester* and the Coprini. Because of the dark, blackish coloring of their gills, they are very apt to get into a mess of either of these species, and when this happens the eater is almost sure to experience symptoms of poisoning. The differentiation of the species is an extremely difficult matter, but, generically, they are easily recognized by their slender stems, grayish or reddish-brown (sometimes hygrophanous), commonly bell-shaped or obtusely expanded caps, and—most important—by the black, or very nearly black, spores that are borne on non-deliquescent gills, generally in spot-like areas, causing the gills to appear mottled with black.

The symptoms from Panæolus poisoning appear very soon after the fungi have been eaten, sometimes within fifteen minutes. They seem to vary slightly, depending, presumably, upon the species and the amount consumed. The following have been recorded: failure of muscular coördination, giddiness, difficulty in standing, inability to walk, drowsiness, lack of control of the emotions (inordinate hilarity), incoherent or inappropriate speech. The sight is usually affected, causing the furniture to appear bent, pliable, and in motion; and there are visions of beautiful colors. Temporary paralysis of a limb may occur.

The effects of the intoxication are said to pass off within a few hours; still, it would seem that emetics ought to be administered without delay to prevent the complete absorption of the poisons.

Photograph by George Shiras, 3d

THE PEAR-SHAPED PUFF-BALL (*Lycoperdon piriforme*)

It is seen growing on and about the base of a tree (for another illustration of this species, see page 418). The plants are edible as long as the "flesh" is white.

Photograph by A. G. and B. Leeper

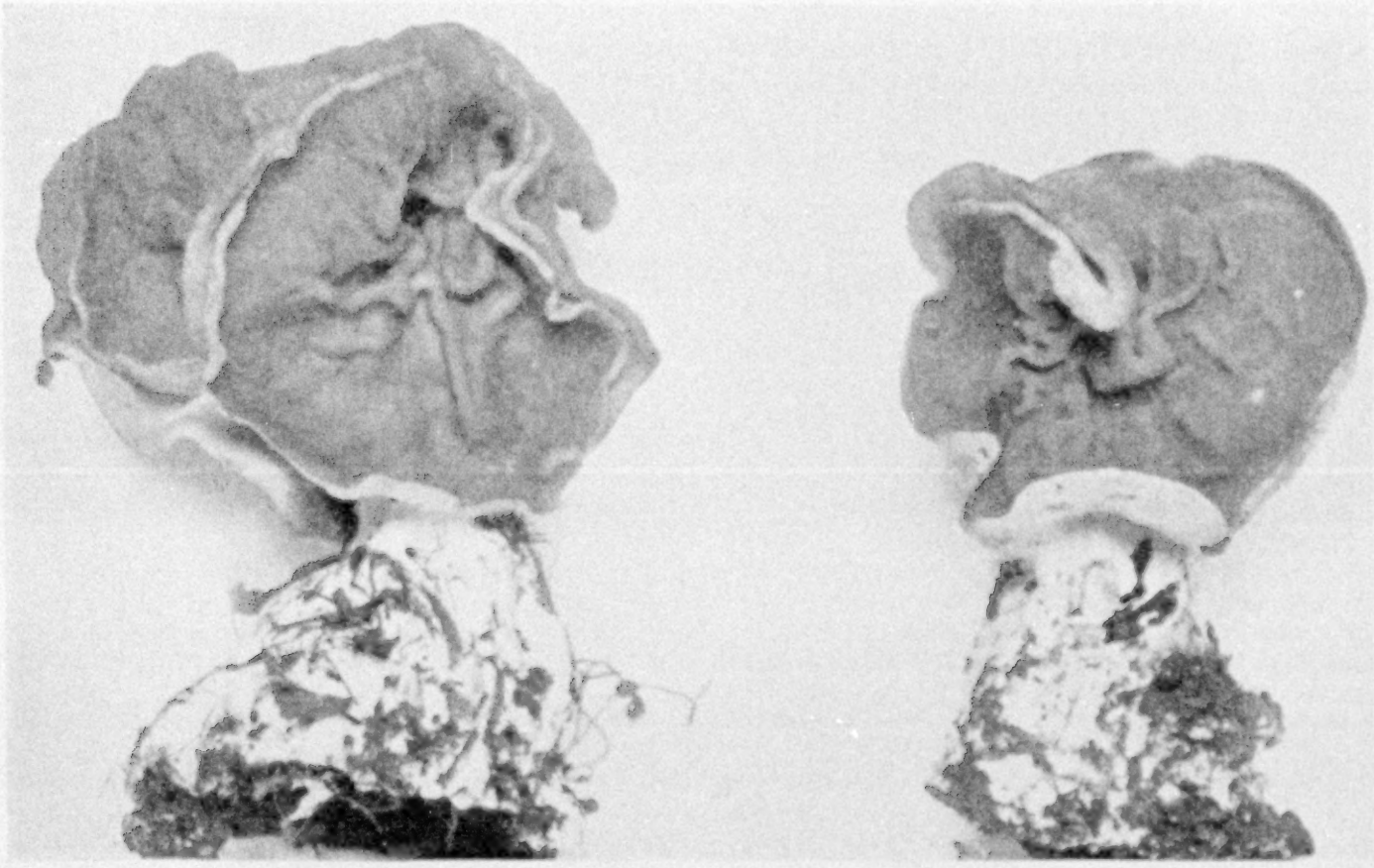
THE SKULL- OR BRAIN-SHAPED PUFF-BALL (*Calvatia craniiformis*)

One of the best, so long as the interior is white. Once the color changes, it is very bitter. Should be looked for in the autumn, in thickets by roadsides. About one-third natural size.

Photographs by A. G. and B. Leeper

MORELS: UPPER FIGURE, *Morchella deliciosa;* LOWER FIGURE, *Morchella conica.* EDIBLE

After a gentle April shower the fungus-hunter will find these delectable mushroom morsels growing in old apple and peach orchards or in recently burnt-over wooded areas. The plants vary in height from two to six inches (see figure, lower right, Color Plate VII, and text, page 417).



THE BROWN GYROMITRA (*Gyromitra brunnea*). EDIBILITY DOUBTFUL

Since one species of Gyromitra is known to be poisonous, it is perhaps just as well to let them all alone. *G. brunnea* reaches a height of seven inches.

Photographs by A. G. and B. Leeper

THE HALF-FREE MORCHELLA (*Morchella semi-libera*). EDIBLE

This morel is small and not as sapid as the larger species. The term "half-free" refers to the attachment of the cap to the stem. The sectional view on the extreme right shows that the cap is only half-attached, or half-free. (For other Morels, see page 420 and figure in lower right, Color Plate, VII.)

LAWN MUSHROOMS (including **Naucoria semiorbicularis**, edibility doubtful, and **Pholiota præcox**, edible)

(*See Color Plate VIII*)

Some one has said that he who wishes to explore the world should begin at his own doorstep. Addressed to the incipient mushroom collector, this maxim imparts wholesome advice, for without stirring far from home—yes, within eyeshot of his front door—he can collect enough species to make a respectable list, and not a few that will give him something more substantial in the way of a delicious snack of mushrooms; also, he is likely to encounter some that are poisonous.

Among the species to be looked for on lawns and other grassy places are:

Naucoria semiorbicularis (see Color Plate VIII, the small cluster and single figure in upper right), is very common on lawns. The caps are somewhat sticky in wet weather and the stems have a characteristic, easily removed, pale pith within. Edibility doubtful.

Pholiota præcox, the early Pholiota (see Color Plate VIII, showing two plants, young and old, lower right). This is another common, edible, mushroom of our lawns. Appears early in the spring. The young plant shows the ring before it becomes detached from the edge of the cap; the older one shows this tissue hanging down and covered with a dense deposit of the rusty-brown spores. The cap of the early Pholiota varies in color from darkish ocher and brownish to a creamy white more or less pale. Occasionally the surface is finely cracked into little areas. The variety shown here grows in thin woods. In young plants the gills are colored a beautiful warm gray.

THE GLISTENING COPRINUS (Coprinus micaceus)

(*See Color Plate VIII*)

The Glistening Coprinus (*Coprinus micaceus*), illustrated on page 404, is familiar to every one. It is one of the first mushrooms to respond to the showers of early spring. Almost any stump will yield hundreds of specimens. To save trouble, the abundant crop should be "harvested" with a pair of shears. When simmered down they make an excellent ketchup.

The minute glistening particles on the cap and the fine, long grooves on the margin of the same at once mark the species.

THE IMPERIAL AGARIC, OR CÆSAR'S MUSHROOM (Amanita cæsarea). Edible

(*See Color Plate IX*)

This brilliantly colored, stately agaric is the famed "boletus" served at the feasts of the emperors of ancient Rome, and lauded in prose and verse by the writers of that period. So highly was it esteemed by epicures that they prepared and cooked the plants themselves, performing these operations with utensils of amber and gold. Special vessels, "boletaria," were used in cooking the boleti, though in some households they doubtless got mixed occasionally with other pots and pans. Martial, in his "Epigrams," lets one that was so treated bewail its fate:

> "Although boleti have given me
> so noble a name, I am now
> used, I am ashamed to say, for
> Brussels sprouts."

From Juvenal we learn that the preparing of boleti by the young patricians themselves was regarded as a sign of the mollycoddle, for he writes:

> "Nor will that youth allow any
> relative to hope better of him
> who has learnt to peel truffles
> and to pickle boleti."

Cæsar's mushroom grows with us today, its distribution being limited, however, to the States east of Ohio. It is especially abundant in the South, and occurs sparingly as far north as Nova Scotia. If there is much showery weather, it may be looked for in open coniferous and deciduous woods from July to October. Occasionally it forms huge "fairy-rings."

Except for the very real danger of confounding it with the deadly *Amanita muscaria* (Color Plates II and XV, and chart, page 389), there is no reason why it should not again become a favorite with those who, like the old Romans, are fond of rare delicacies. But those who wish to try it should postpone the pleasure until they are thoroughly familiar with a considerable number of Amanitas, as an error in observation may mean death, preceded by horrible agonies (see the symptoms of poisoning by *Amanita muscaria*, on page 403).

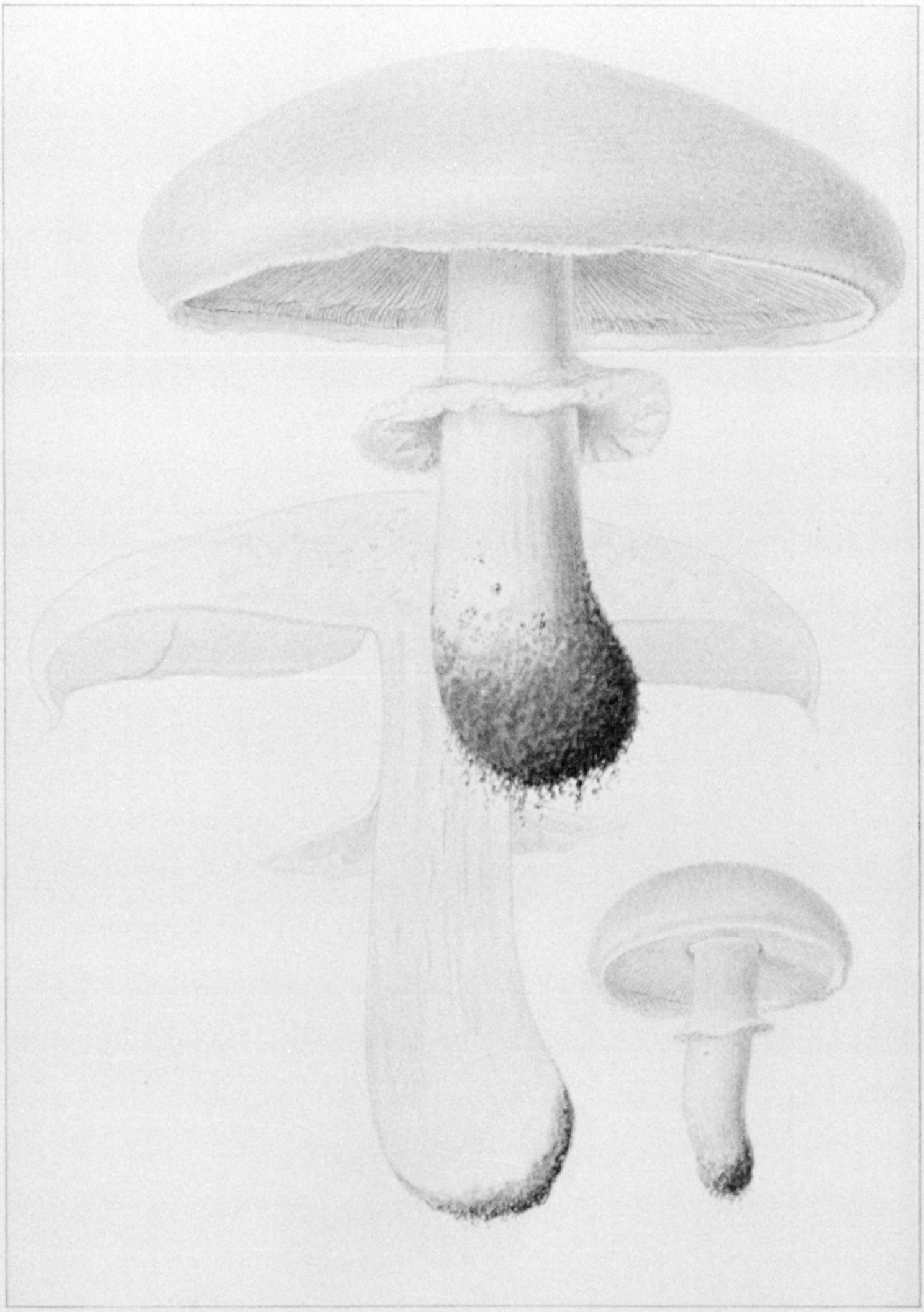
No difficulty will be experienced in avoiding the citron-colored variety of the deadly *Amanita phalloides* (see figure at extreme right of Plate V). The cap in that variety is never orange, the gills and stem are never clear yellow, and the volva is composed of short, thick segments surrounding the upper part of the large, globular base of the stem.

[For Color Plate X, see the Deadly Amanita, page 409).

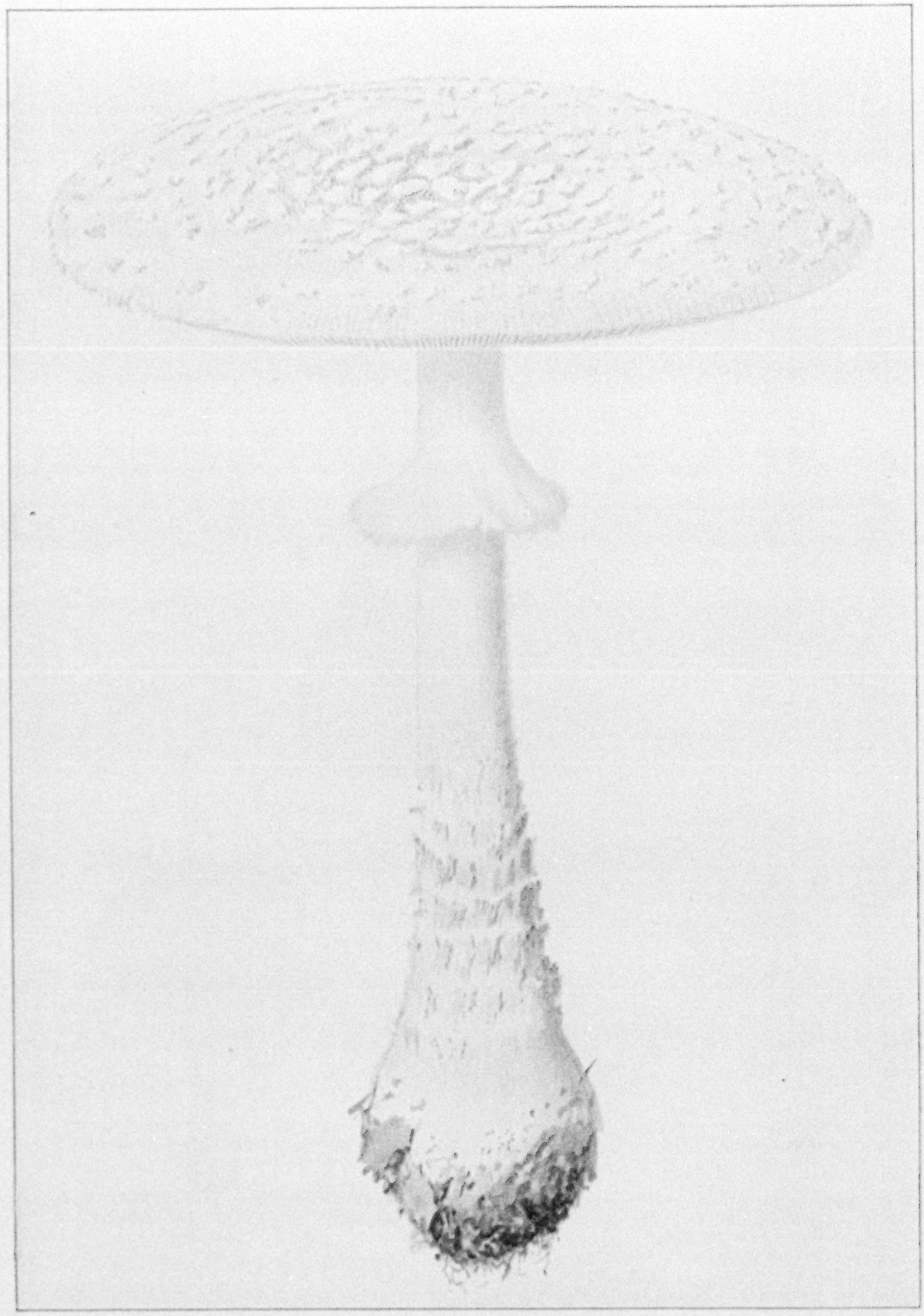
THE SOOTY LACTAR (Lactarius ligniotus). Edibility doubtful

(*See Color Plate XI*)

To the city dweller, who through force of circumstances is allowed a limited number of cubic feet of air in which he must "live, move, and have his being," it must be tantalizing to read that this attractive lactar leads its life in the cool, mossy depths of the vast fir forests. In the hot months of July and August, the time of its occurrence, it is well to have ready this excuse for an outing: "I am going in quest of the sooty lactar."

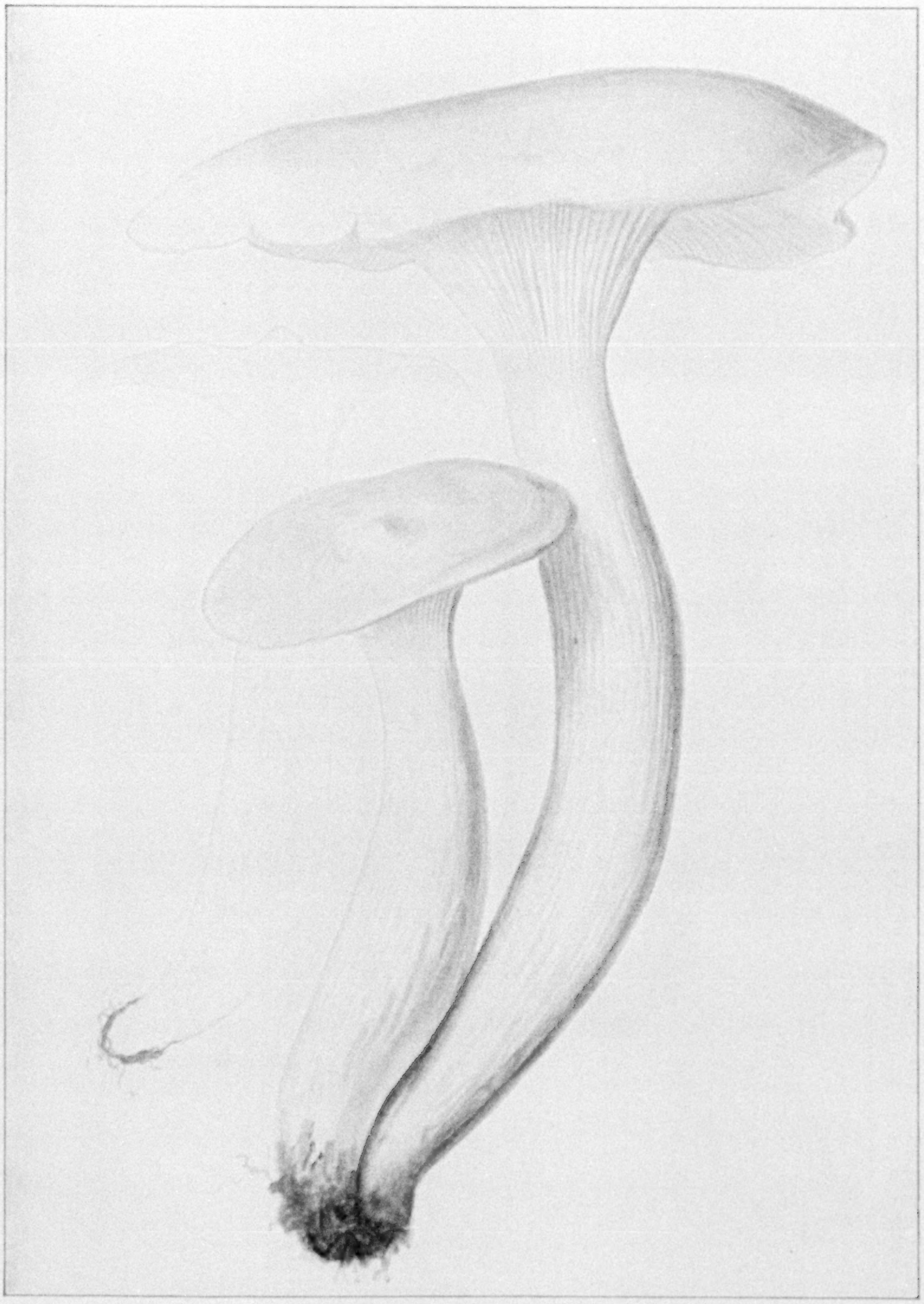


THE FIELD, OR HORSE MUSHROOM (*AGARICUS ARVENSIS*): Edible
The large plant and sectional view. Somewhat reduced in size.
The strong, sweetish odor given off by this agaric is objectionable to some.
THE COMMON MEADOW-MUSHROOM (*AGARICUS CAMPESTER*): Edible
Figure at lower right. Under natural size.
When the average person says "mushroom," it is this species that is meant.



THE FLY-MUSHROOM (*AMANITA MUSCARIA*): Deadly poisonous
Mature specimen. Somewhat under natural size.

This species and *Amanita phalloides* (see Nos. X and XVI) are the common causes of serious mushroom-poisoning (for figures of young plants, see No. XV).

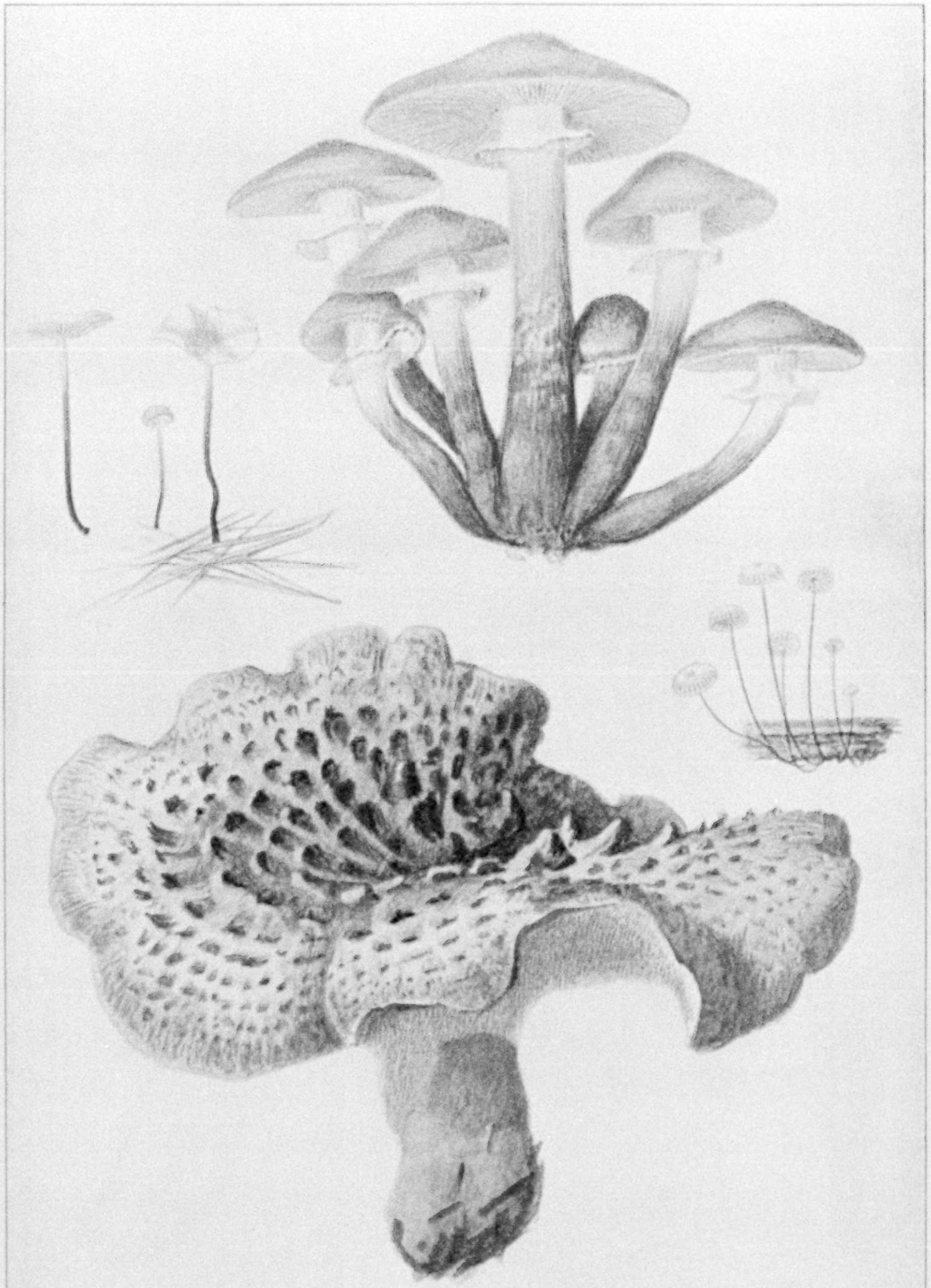


JACK-O'-LANTERN (*CLITOCYBE ILLUDENS*): Poisonous
About four-fifths natural size.

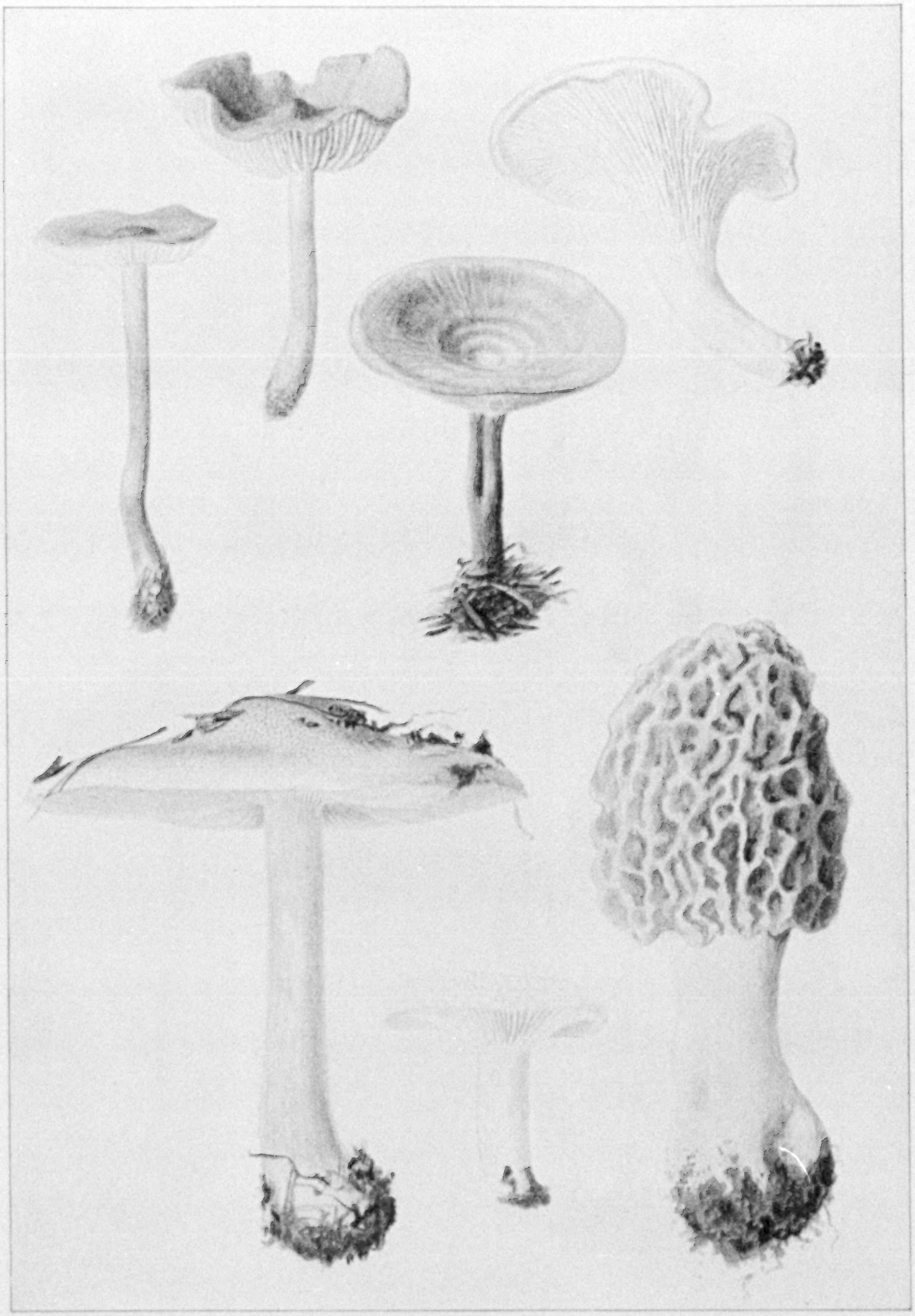
A conspicuous object by daylight, this Clitocybe is also visible in the profoundest darkness, the phosphorescent light which it emits betraying its presence. Should not be confounded with the edible Chantrelle (see No. VII, figure at upper right).

THE EDIBLE BOLETUS, THE "CÈPE" OF COMMERCE (*BOLETUS EDULIS*)
Somewhat under natural size.
The mushroom connoisseur should cultivate the acquaintance of this most excellent species.

Figure on left: THE HANDSOME VOLVARIA (*VOLVARIA SPECIOSA*). Edibility doubtful. In the genus Volvaria there is a volva, but no ring; the spores and gills are pink or reddish, and the latter are free from the stem. Middle figure: CLAVARIA FUSIFORMIS. Like tongues of flame, this beautiful Clavaria shoots from the mossy beds of cool, moist woodlands. It is edible. Figure on right: THE LEMON-YELLOW AMANITA (*AMANITA CITRINA*). Deadly poisonous. Some mycologists consider this a variety of *Amanita phalloides* (see Nos. X and XVI).

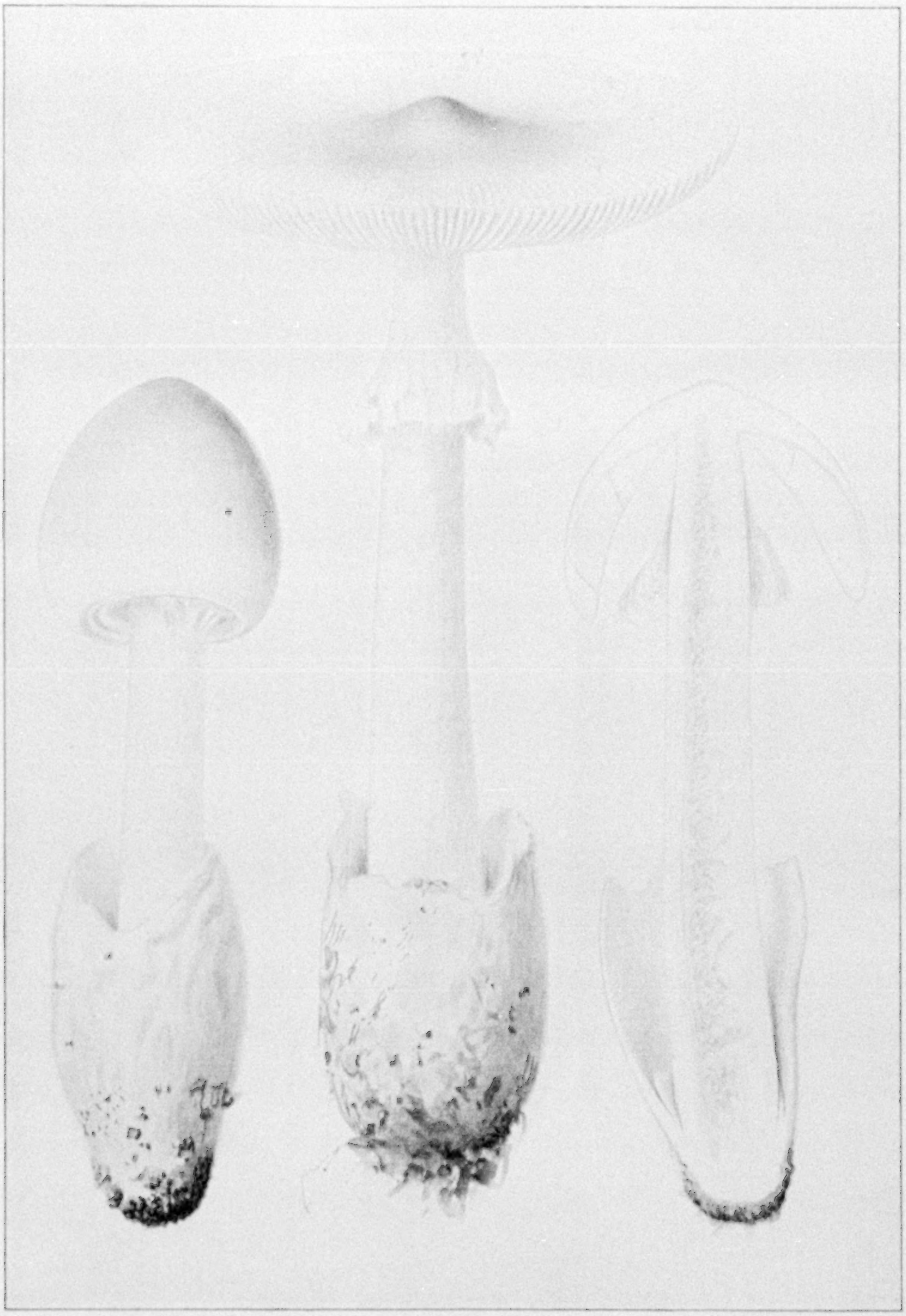


Upper figure: THE HONEY MUSHROOM, OR OAK FUNGUS (*ARMILLARIA MELLEA*): Edible. This common agaric is the bane of the orchardist (see also photographs and text). Figure in the middle on the left: THE GARLIC MUSHROOM (*MARASMIUS SCORODONIUS*): Edible. The odor of garlic is so pronounced in this little species that the "nose knows" it before the eye sees it. Figure in the middle on the right: THE LITTLE WHEEL MUSHROOM (*MARASMIUS ROTULA*): Edible. When garnishing venison, this dainty Marasmius adds the appropriate touch of the wild woodlands. Lower figure: THE FINNISH HYDNUM (*HYDNUM FENNICUM*). This species is too bitter to be eaten, but the nearly related *H. imbricatum* is a great favorite with European peoples. All figures about two-thirds natural size.



Upper left: THE CINNAMON CORTINARIUS (*CORTINARIUS CINNAMOMEUS*). The Cinnamon Cortinarius is not highly recommended as an edible species. Upper right: THE CHANTRELLE (*CANTHARELLUS CIBARIUS*): Edible. (See *Clitocybe illudens*, No. iii.) Upper middle: THE PERENNIAL POLYSTICTUS (*POLYSTICTUS PERENNIS*). "Stalking" fungi, the hunter, sensitive to beauty as well as usefulness, must stop to admire this species. Lower left: THE EQUESTRIAN TRICHOLOMA (*TRICHOLOMA EQUESTRE*): Edible. They appear in our forests late in autumn. Lower right: THE MOREL (*MORCHELLA ESCULENTA*): Edible. Esteemed by epicures. Lower middle: THE DELICIOUS, OR ORANGE-MILK LACTAR (*LACTARIUS DELICIOSUS*): Edible. "It is very luscious eating, full of rich gravy, with a little of the flavour of mussels." All figures about two-thirds natural size.

Upper left: A species of PANÆOLUS (poisonous). Upper right: NAUCORIA SEMI-ORBICULARIS (edible qualities doubtful). Lower left: THE GLISTENING COPRINUS (*COPRINUS MICACEUS*): Edible. Lower right: THE EARLY PHOLIOTA (*PHOLIOTA PRÆCOX*): Edible. All figures about two-thirds natural size.

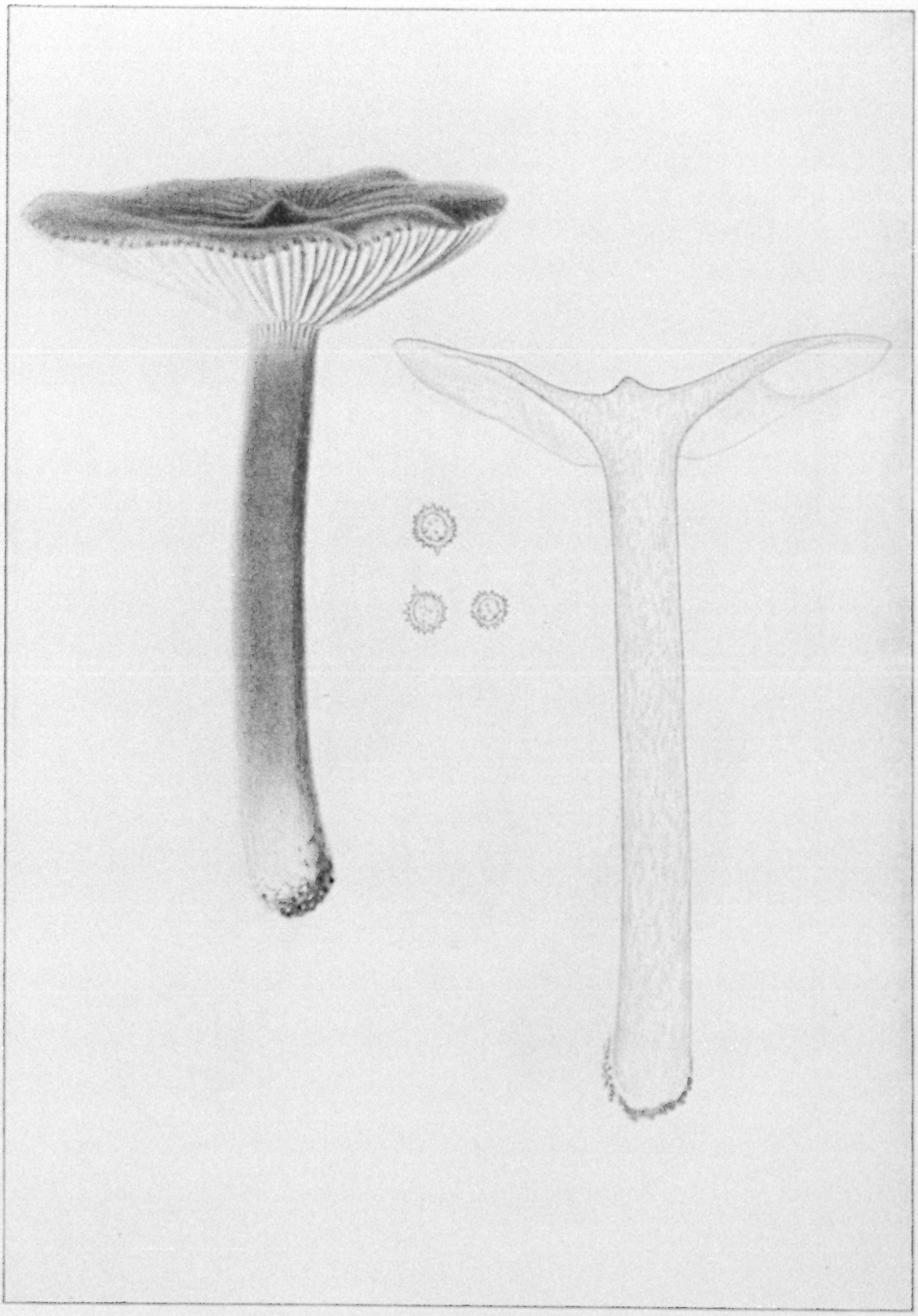


CÆSAR'S MUSHROOM (*AMANITA CÆSAREA*): Edible
Somewhat under natural size.

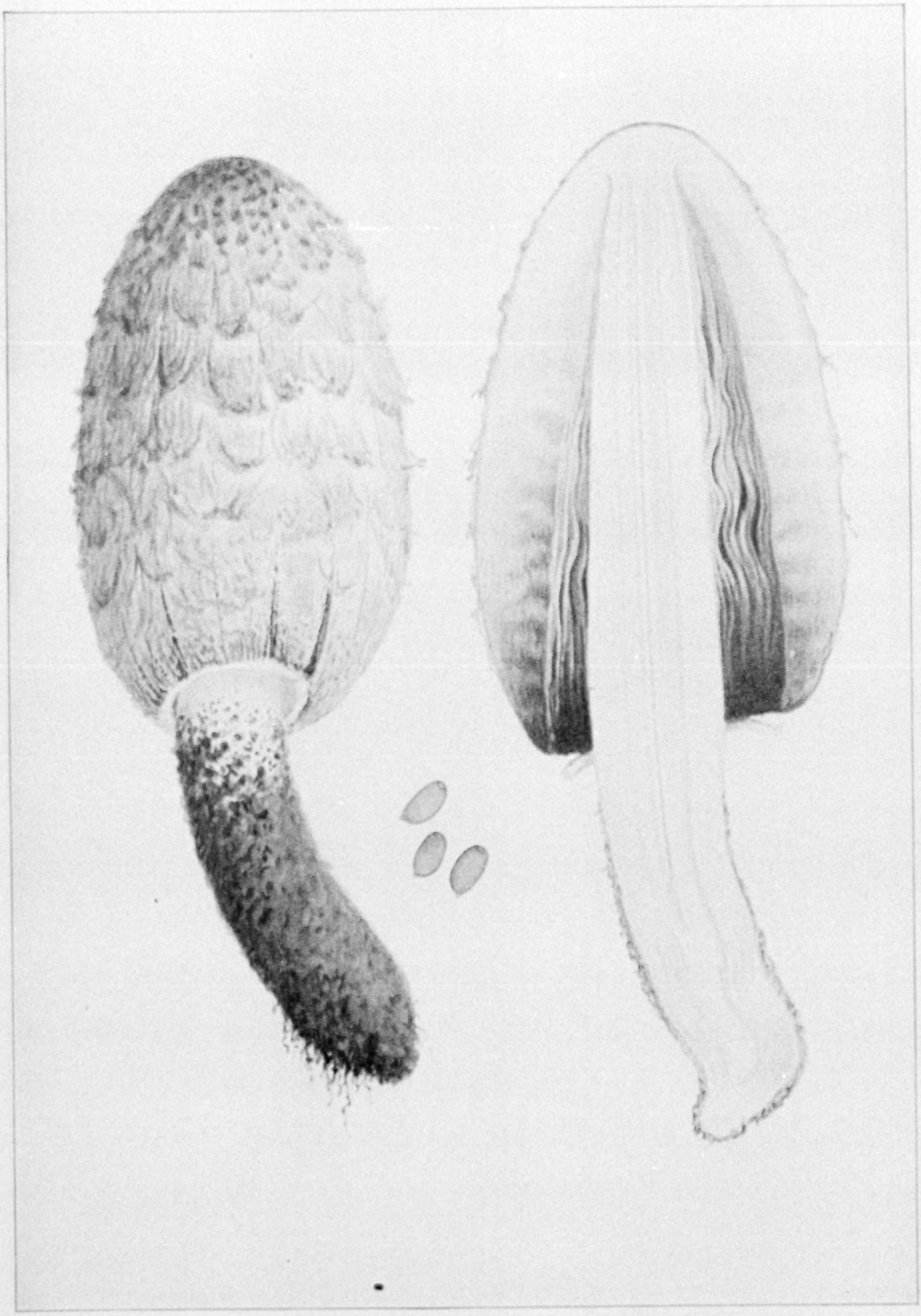
History tells us that a dish of this mushroom, "seasoned" with mineral poisons, constituted the last meal of the Roman Emperor, Claudius Cæsar. His wife, Agrippina, did the seasoning.

THE DESTROYING ANGEL (*AMANITA PHALLOIDES* VAR. *VIROSA*).
Deadly poisonous. About four-fifths natural size.

One of the worst of the man-killing mushrooms. Note the "death-cup" at the base of the stem (see No. XVI; and No. V, figure on right).



THE SOOTY LACTAR (*LACTARIUS LIGNIOTUS*): Edibility doubtful
Somewhat under natural size.
The play of light on the velvety coat of this species attracts the artist who delights in texture rendering.

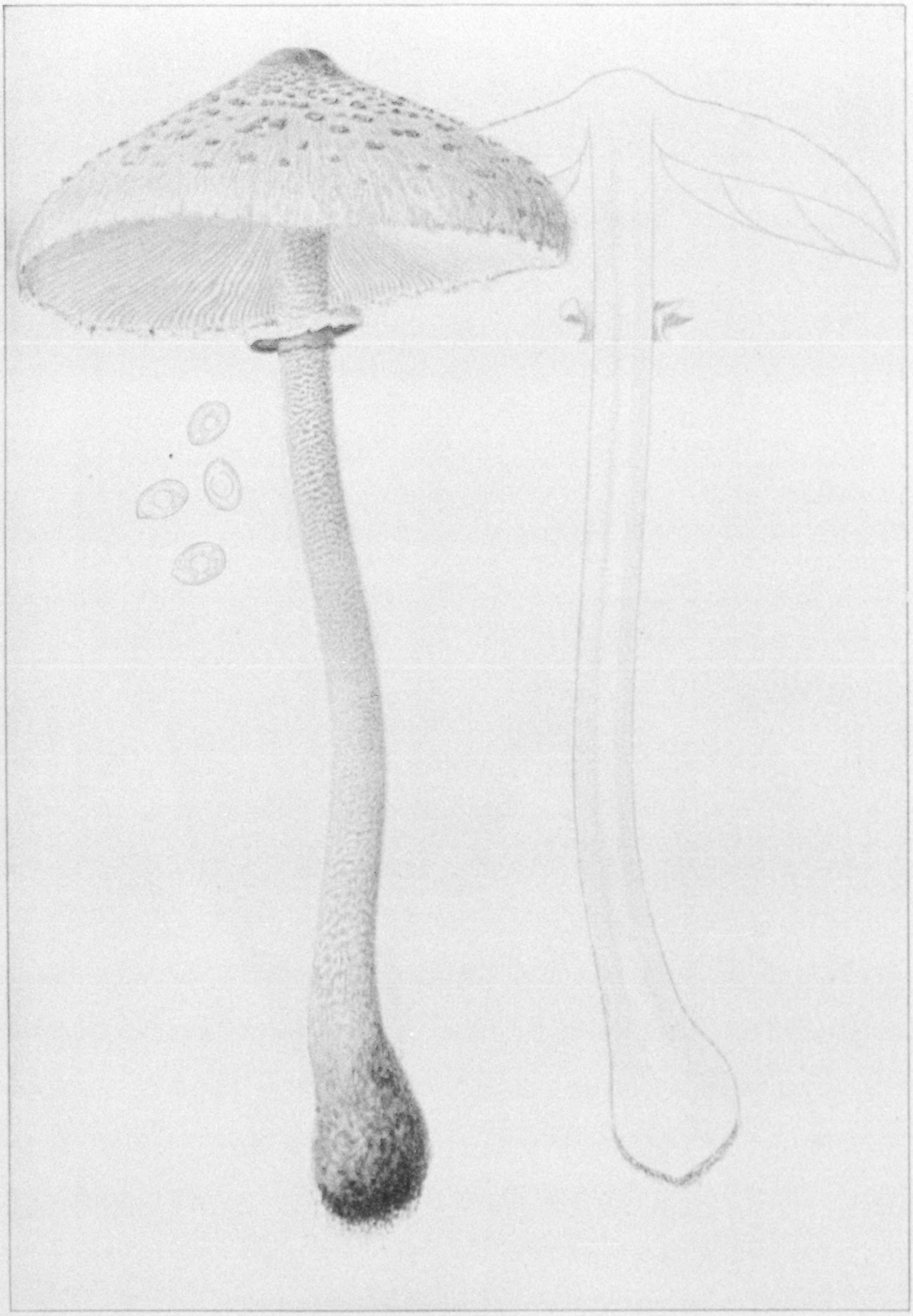


THE SHAGGY-MANE (*COPRINUS COMATUS*): Edible
About four-fifths natural size.

The oval caps of the Shaggy-mane, poised on end, like Columbus' egg, are familiar objects on lawns and other rich grounds. Note the "cord" suspended in the hollow of the stem.

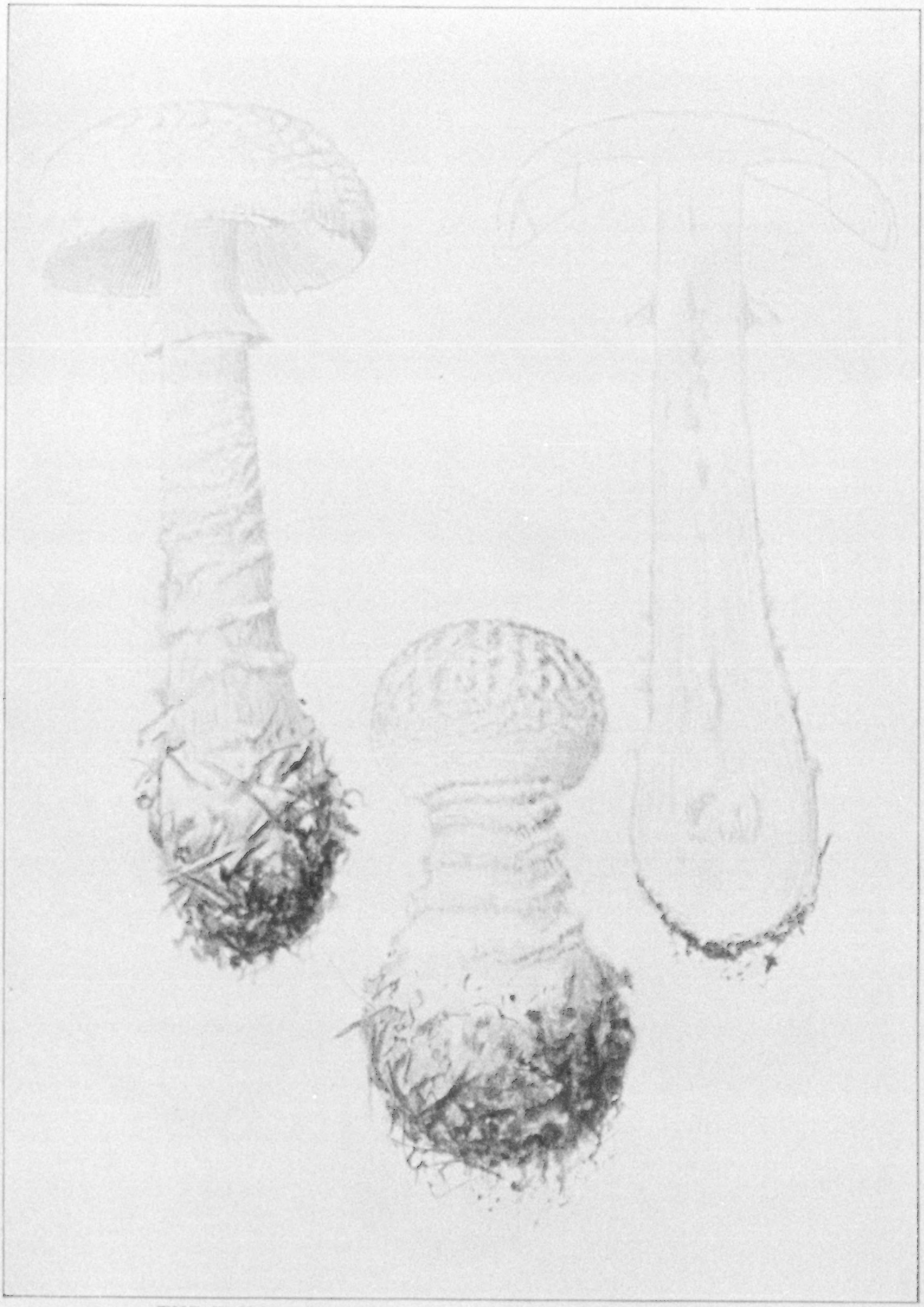
THE GYPSY (*PHOLIOTA CAPERATA*): Edible
Somewhat under natural size.

Though commonly known as *Pholiota caperata*, this species has been so much thrown about, from genus to genus, that, like the gypsies, it may be said to be quite homeless; whether this is the reason for its common name has not been ascertained.

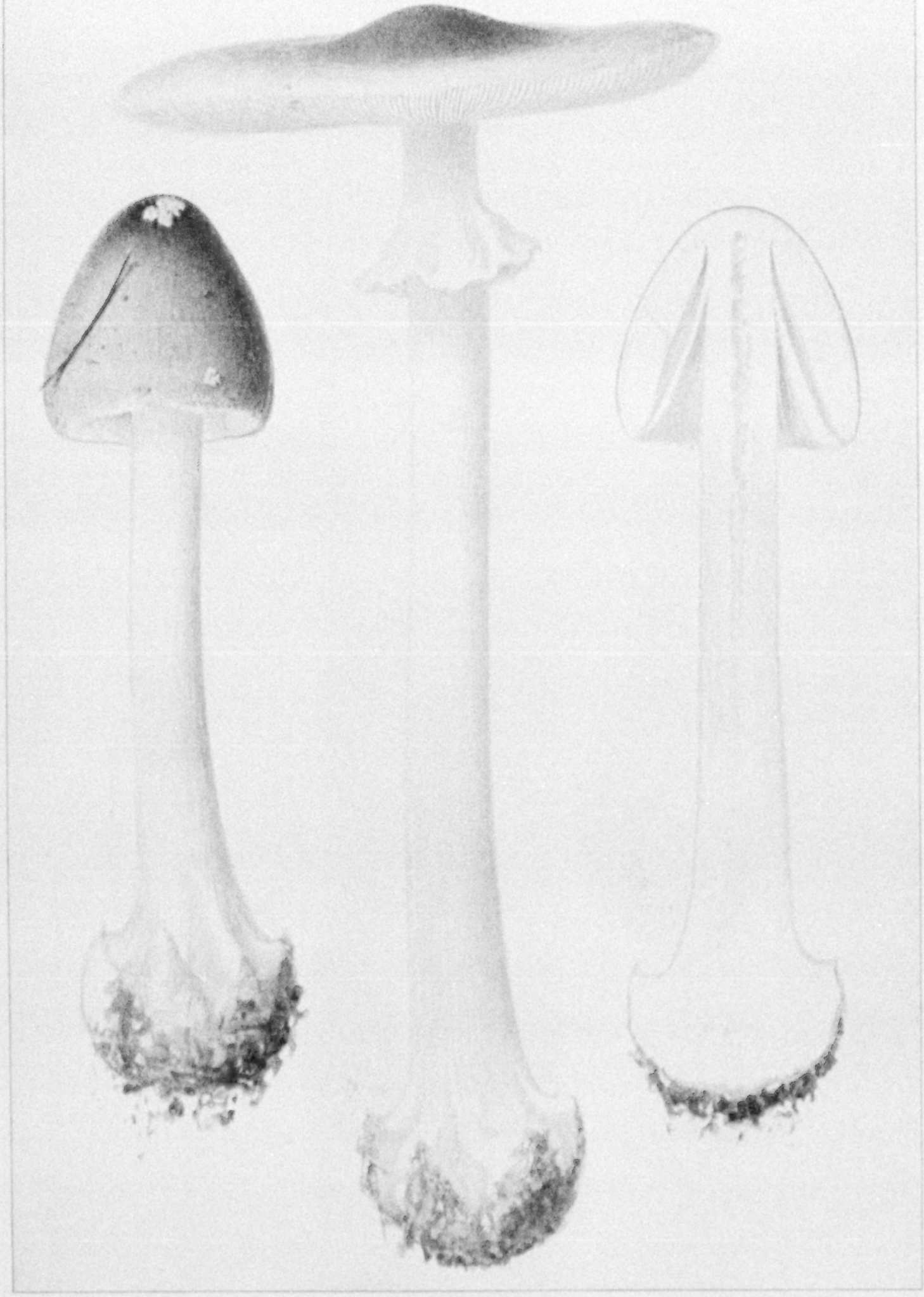


THE PARASOL MUSHROOM (*LEPIOTA PROCERA*): Edible
About four-fifths natural size.

The Parasol is a prime favorite with mushroom eaters—so much so, that one shares a mess of it only with one's best friend.



THE FLY-MUSHROOM (*AMANITA MUSCARIA*): Deadly poisonous
Young specimens. Natural size.
A mature specimen is shown in No. II.



THE DEADLY AMANITA (*AMANITA PHALLOIDES*)
Somewhat under natural size.

The avoidance of *Amanita Phalloides* and *A. muscaria* (see No. II) should be the first concern of the mycophagist.

Fully to appreciate its beauty, one should see the plant in Nature's own setting, as it reposes upon a fresh, green, mossy bank at the foot of a great fir, with the crystalline drops of the morning dew still studding the smooth, velvety coat, with birds singing overhead and squirrels scolding us for calling at such an unseasonable hour in the morning.

THE INK MUSHROOMS, OR INK-CAPS (Species of Coprinus)

(See Color Plate XII)

The Ink-caps need no formal introduction, for every one has seen the "Shaggy-mane" (Coprinus comatus) (Color Plate XII) standing on end, like Columbus' egg, in lawns and other grassy places. If one returns later one may behold

"Their mass rotted off them flake by flake,
Till the thick stalk stuck like a murderer's stake,
Where rags of loose flesh yet tremble on high,
Infecting the winds that wander by."

Shelley's lurid lines allude to the liquefaction of the caps, a feature which at once distinguishes the Coprini from other black-spored agarics. It is, however, not a process of putrefaction, as the poet would have us believe, but a natural physiological one.

Shaggy-manes are rapid growers, and, coming up in dense masses, as they sometimes do, they are capable of producing considerable pressure upon objects that obstruct their growth. The writer knows of a case where a thick, newly laid concrete walk was broken up for some distance by a colony of these large, yet tender, mushrooms.

The black "ink" into which the caps of Coprini dissolve can be employed for writing. Indeed, in France, during the war, it was proposed that Coprinus ink be used in place of the regular article, which was becoming more and more expensive. But even in peace times the mushroom ink would prove valuable, as it could be used in legal documents or in any important papers that are apt to be fraudulently imitated.

Ink from some especially rare species with well-marked spore characters would be well-nigh impossible to imitate, as the microscope would divulge instantly and beyond peradventure whether the fluid was obtained from the rare Coprinus. To make matters still more difficult for forgers, characteristic, easily recognized spores from other rare species—not necessarily black-spored nor from agarics—could be added to this forgery-proof and indelible writing fluid. Small amounts of gum arabic and essence of cloves in the ink will give adhesiveness and a pleasant odor.

The edibility of the Coprini (see also Glistening Coprinus, Color Plate VIII) is unquestioned by most writers, but care should be exercised that only fresh specimens are utilized, and that they be cooked without delay, as deliquescence sets in very soon.

THE WRINKLED PHOLIOTA, OR THE GYPSY (Pholiota caperata). Edible

(See Color Plate XIII)

The ocher-colored cap with whitish, fleecy, silky fibrils scattered over the central portion, the brownish-yellow, longitudinally wrinkled, saw-edged gills, together with the slightly volvate, whitish stem that bears a double-edged ring about midway of its length, make the Wrinkled Pholiota one of the most easily recognized species.

It is quite common, growing scattered or gregariously in woods (especially of pine), in mossy swamps, and in open places, from July to October. Its edibility is unquestioned.

THE PARASOL MUSHROOM (Lepiota procera). Edible

(See Color Plate XIV)

Happy is the mushroom-hunter if, after a foray, his "bag" includes many Parasols, for it is not often that he encounters this most desirable species in sufficient quantity to satisfy his appetite.

Though pretty effectually camouflaged in coloring, its great height makes it a conspicuous object. A giant specimen once reported to the writer measured seven inches across the cap and twenty-two inches in stem length. This monster mushroom was found growing among low blueberry bushes—a fact that would seem to indicate an acid food requirement for the species.

Successful efforts have been made in France to cultivate the plant from its spores, and Professor Duggar, in this country, has demonstrated that it responds vigorously to the tissue-culture method. It is to be hoped that some of our pure-culture spawn-producers will take up the problem and produce the spawn on a commercial scale, so that it may be bought by growers. *Lepiota rhacodes,* a near relative and just as desirable, might prove even more responsive to culture methods.

In the opinion of gourmets, the Parasol mushroom is at its best when quickly broiled over the live embers of a camp-fire, with just enough basting with hot butter to keep it from burning. Then, properly seasoned and served with a partridge or two, the gustatory apparatus experiences sensations not readily forgotten.

Such an eventuality as an oversupply almost never happens, but if by rare chance more specimens should be collected than can be at once disposed of, it is well to remember that dry they are even better than fresh.

The habitat of the Parasol mushroom is meadows, pastures, and open, thin woods; time, summer and early autumn; distribution, cosmopolitan.

[For Color Plate XV, see the Fly Mushroom, page 403.]

[For Color Plate XVI, see the Deadly Amanita, page 409.]

HURDLE RACING IN CANOES

A Thrilling and Spectacular Sport Among the Maoris of New Zealand

By Walter Burke

THE title of this article sounds like a fairy tale; yet hurdle racing in canoes is a highly developed sport among the New Zealand Maoris.

Two or three things are necessary for the sport: First, the canoes must be dug-outs. The dainty canoes so popular on the American lakes and rivers and the beautiful birch-barks of the Canadian voyageurs would be too fragile, crumpling up like matchwood at the first hurdle.

A swift-running river is also desirable, in order that the crews may have the help of the increased speed given by the current to carry the centers of the canoes over the hurdle. This is an important consideration, as can be seen from the photographs. And the contestants must be good swimmers. As every Maori—man, woman, or child—is, there is no risk of drowning, even in the roughest water.

One sees the game at its very best at Ngaruawahia, a village in the North Island, a little south of Auckland, on the seventeenth of March in any year—St. Patrick's Day.

At this point the Waikato, one of the finest rivers in the Dominion, widens out and sweeps round a bend to meet another branch. The river carries a great volume of water, draining an enormous watershed in the center of the island, including Lake Taupo, into which some thirty streams discharge. The Waikato plunges over the Huka Falls, a miniature Niagara, below which are the Aratiatia Rapids, quite impassable for any boat. It is at this point that it is proposed to generate sufficient electricity to run the railway system of the North Island.

Prior to *the* day, the Maoris collect from all the adjacent territory, bringing with them their prize canoes, each dug out of the trunk of a tree. Some of these boats are large enough to carry a crew of from thirty to more than forty paddlers. These are not for hurdling, however!

The secret—more or less—trials proceed; training is keen and hard; the betting heavy, for most Maoris are well-to-do and are keen sportsmen, willing to gamble on anything, from "fly loo" to a horse-race! The excitement progresses till the eventful day, when special trains bring immense numbers of Maoris and Pakehas (white people) from far and near.

The program includes many and varied events, but the great attraction is the hurdle racing, just as the steeplechase attracts the eager crowd at a turf event. Of course, in saying this, I am not belittling the excitement over the big canoe races. There is not the fun in these, however, as there are no accidents, while the hurdle racing is one continuous series of them—a spill at practically each hurdle, of which there are usually three or four.

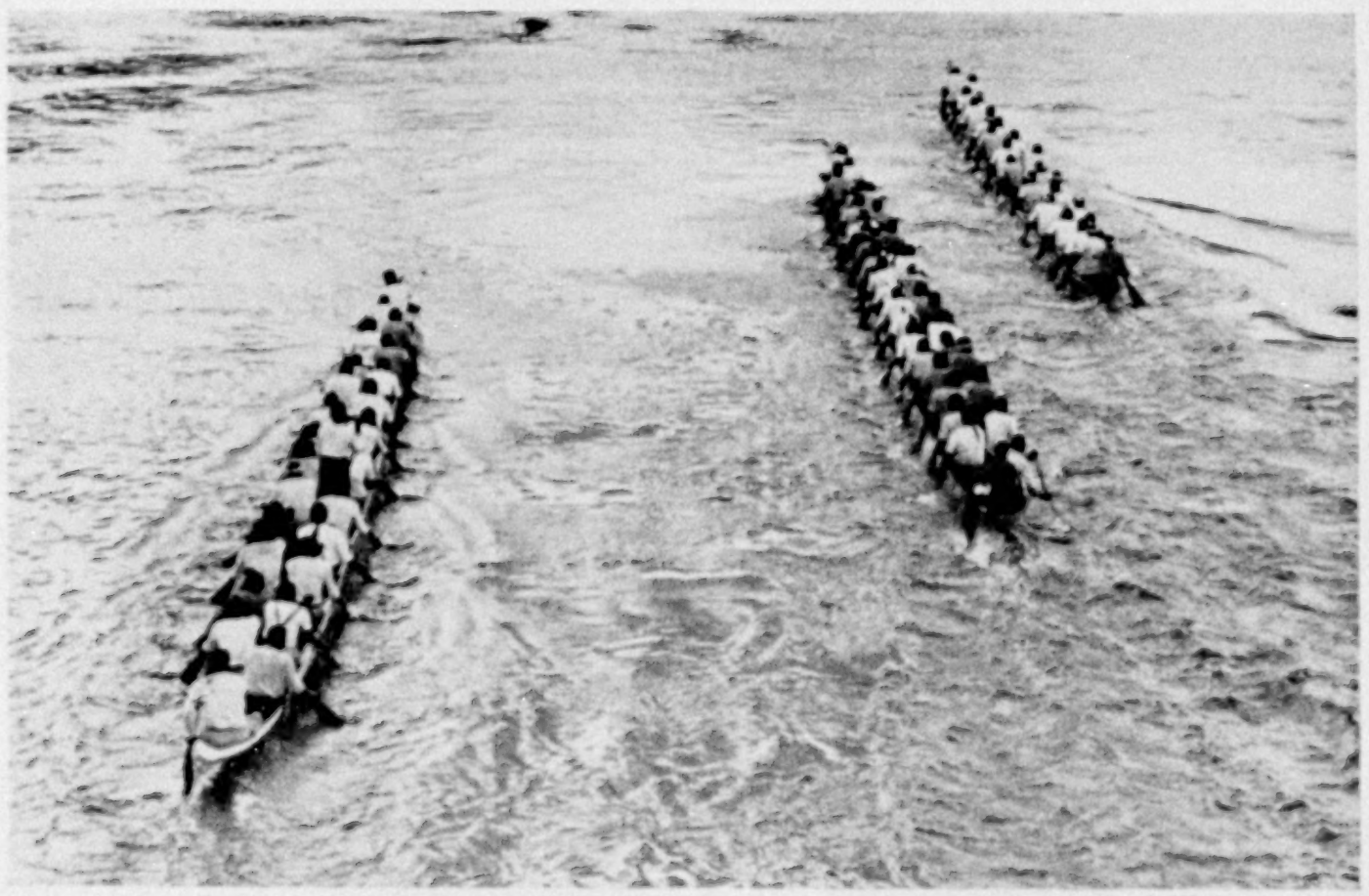
Unless the bow of the canoe is well out of the water, it cannot take the hurdle, which is from twelve to eighteen inches above the surface. The object is to get up such speed that when the bow slides on to the hurdle the smooth and well-greased bottom will continue to glide till past the center of gravity, when the members of the crew run forward and their weight causes the bow to go down with a "flop" and the stern slides off. The bow usually dips under and partly fills the canoe with water, which is removed by rocking or is splashed out with the aid of the flat of the paddle.

This is the program when all goes well! And it will probably happen when one canoe can shoot away from the others and negotiate the first hurdle alone. But usually about four or five canoes come down almost simultaneously, the crews yelling like fiends, and there is a thrilling mix up, from which the brainiest crew, with the best of luck, gets out of the ruck and away.

© Walter Burke

MAORI WOMEN ARE SKILLFUL PARTICIPANTS IN THESE CONTESTS; THIS IS A RACE FOR MATRONS

One boat has upset. The Maori women, like the men, are expert swimmers and a spill in the water is not fraught with danger.



© Walter Burke

NINETY PADDLES CHURNING THE WATER

Note the uniformity of stroke and the level keels. The use of a hollowed log as a canoe makes skill a necessity. The principal races among the Maoris of New Zealand take place on St. Patrick's Day.

© Walter Burke

HURDLE RACING IN CANOES: A MARINE VERSION OF "OVER THE TOP"

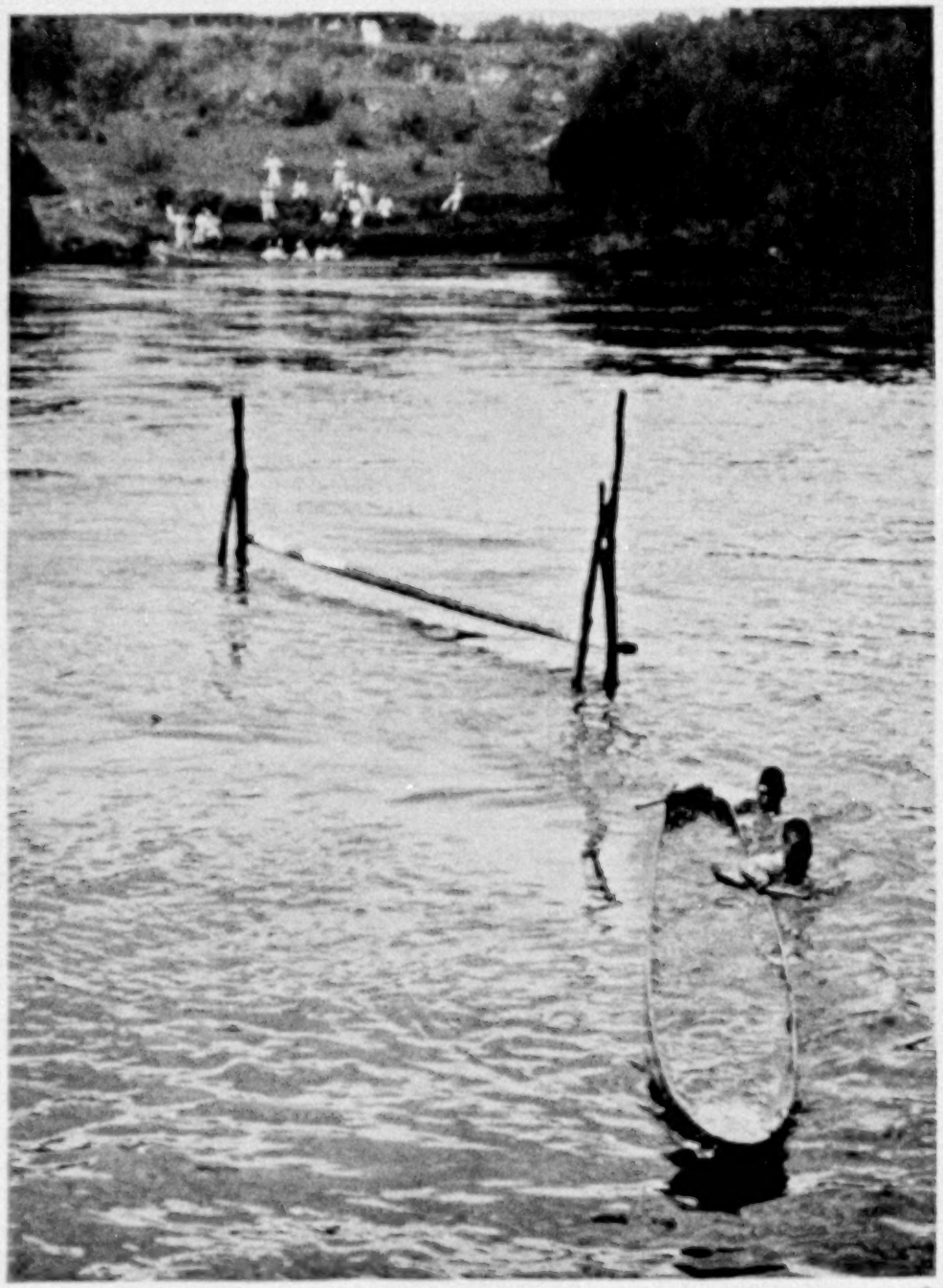
Boat-racing, hurdling, and the good old game of teeter-board are combined in this contest. One of the boats is rising to the hurdle, the weight having been shifted to the stern. Another is debating whether to tip forward or back, and the favorite is over and off with a splash. No lumberjack in a log-jam ever had more thrills.

XUM

© Walter Burke

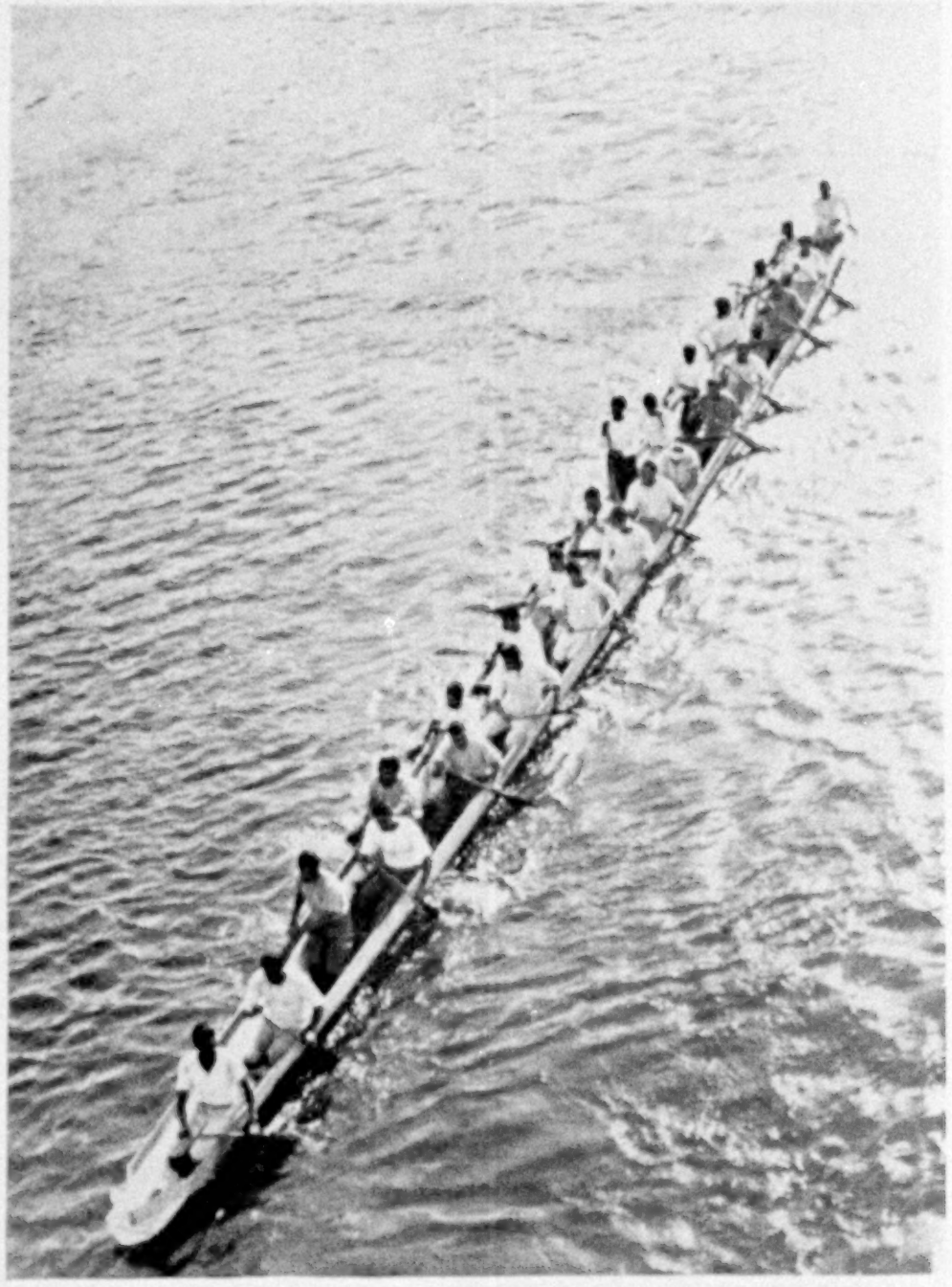
A THIRTY-MAN-POWER DUGOUT MAORI CANOE

When thirty persons set out to break paddling records in a single log, it is well to ask whether they can swim. Every Maori can. The sides of the log are sometimes heightened by planking, but a promenade deck above the "engine-room" is an improvement still undeveloped.



WHEN CHEERS BECOME JEERS

These overturned hurdle-racing contestants are literally "in it up to their necks." The fine lines of the Maori dugout can here be seen to advantage.



© Walter Burke

HIAWATHA USED THE BARK; MAORIS USE THE TRUNK

The leader stands in the middle of the boat. Many of these strong-limbed young Maoris won fame or death as "Anzacs" in the World War.

MALTA: THE HALTING PLACE OF NATIONS

First Account of Remarkable Prehistoric Tombs and Temples Recently Unearthed on the Island

By William Arthur Griffiths

Original photographs by courtesy of R. Ellis and Lieutenant Tickle

MALTA is but a tiny island, less than a hundred square miles in area, with no special beauty of hill or dale, almost without tree or stream, yet by the inscrutable decree of Destiny it has been called to fill a great rôle in the history of the world.

Situated in the narrowest part of the Mediterranean, it lies in the direct route from Gibraltar to Port Said or the Dardanelles, midway from Italy to its turbulent colony of Tripoli and from the French territory of Tunis to their watch-tower at Corfu, at the mouth of the Adriatic (see map, page 449).

Nature has thus ordained that Malta, by reason of its position, should form a center from which naval activity in this sea can be controlled.

"Some are born great . . . and some have greatness thrust upon them." It is to the latter class that Malta belongs.

Since the outbreak of the World War, Malta has resembled the Tower of Babel after the confusion of tongues. In its harbors transport after transport has anchored, each crowded with troops of varied race—English, Scot, Irish, Welsh, Australian, New Zealander, French, Italian, Portuguese, Russian, Japanese marine, Serbian, Montenegrin, Greek, Cretan, Hindu, Bengali, Gurkha, Pathan, men from Ceylon and the Straits, Maori, Chinese, Annamite, Tonquinese, Egyptian, Moor, Arab, Tunisian, Congolese, Senegalese, Zouave and Chasseur d'Afric, gay Bersaglieri—in seemingly unending procession.

Here also came, as prisoners, Austrians, Bulgars, Turks, and Germans, some from the famous *Emden*.

Malta was indeed a Haven of Refuge, and all too soon they passed onward, some to find a watery grave, many more to die by murderous poison gas, by fiery burning oil, or by more merciful shot and shell.

Soon Malta became the Island of Hospitals, where the sick and maimed, the fever-stricken and blind, found such rest and comfort as this world can give. Ere long this privilege was denied, as the enemy submarine spared neither hospital nor passenger ship, woman nor child.

"A PLACE OF CURSED STEPS"

Malta has thus been the halting place of many nations, and one wonders what thought or message it has given to them. "A place of cursed steps," was Byron's unpoetic tribute. "Bells, yells, and smells" is the terse but graphic description of the British bluejacket, while to the majority of visitors it is merely a treeless waste of arid stone, almost incandescent in the blinding glare of the summer sun.

In each of these descriptive phrases there is much truth; yet to those who peer below the surface Malta is one of the treasure-houses of the world, where the history of mankind can be read in lasting tables of stone.

Untold ages ago coral insects laid the early foundations of Malta, their work being afterward submerged to a great depth. Memorials of the latter period are found in the beautifully enameled teeth, about six inches long, of sharks now extinct, identical with those dredged up in the deepest part of the Pacific Ocean by the *Challenger* deep-sea expedition.

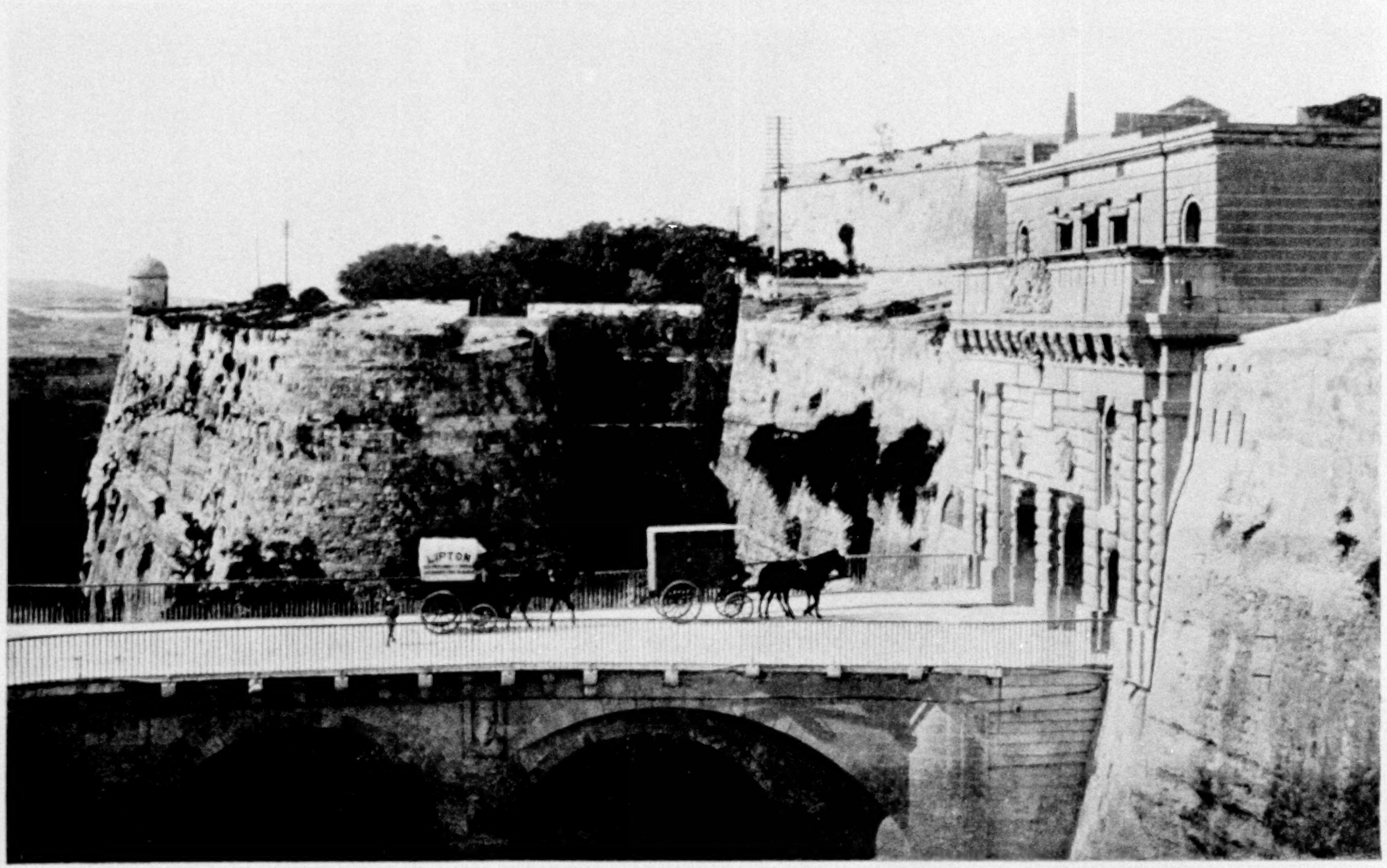
Slowly the land rose again, receiving the soil and debris from the fresh-water river of some continent now unknown. Thus were formed the marl beds to which Malta owes her means of maintaining life, as without this layer of clay the rain would sink and be lost. Next came a layer of sand, and again the coral insect brought the land to the surface of the

A VIEW OF THE WATER FRONT AT VALLETTA, SHOWING A PART OF THE BRITISH MEDITERRANEAN FLEET AT ANCHOR

Photographs by S. L. Cassar

GRAND HARBOR AND THE BRITISH SALUTING BATTERY IN THE FOREGROUND: MALTA

Malta has been a British possession for more than a hundred years. Valletta, its capital, is one of the most important ports of call in the world and is the base and resort for repair and refitment of the British fleet in the Mediterranean. The entrance of the harbor is to the left. A steamer can be seen departing through the narrows.



Photograph by S. L. Cassar

THE GATE TO VALLETTA, SHOWING THE OLD WALLS OF THE CITY AND THE MOAT

Valletta takes its name from its founder, Jean de la Vallette, who was Grand Master of the Order of the Knights of Malta during the famous siege of the island in 1565, when the forces of Sultan Suleiman the Magnificent, under Dragut, were defeated. The defenders numbered between 6,000 and 9,000, while the assailants were variously estimated at from 29,000 to 38,500. Grand Master Vallette had previously participated in the defense of Rhodes, had been captured by Dragut and made to row as a galley slave until ransomed (see page 453).

Photograph by Helene Philippe

THE FORTIFICATIONS OF VALLETTA ARE PARTLY HEWN IN THE ROCK

Enthroned above its harbors, the chief seaport of the Maltese group of islands is one of the most picturesque cities of the Mediterranean.

sea. Many changes occurred, until Malta emerged as part of a mighty continent.

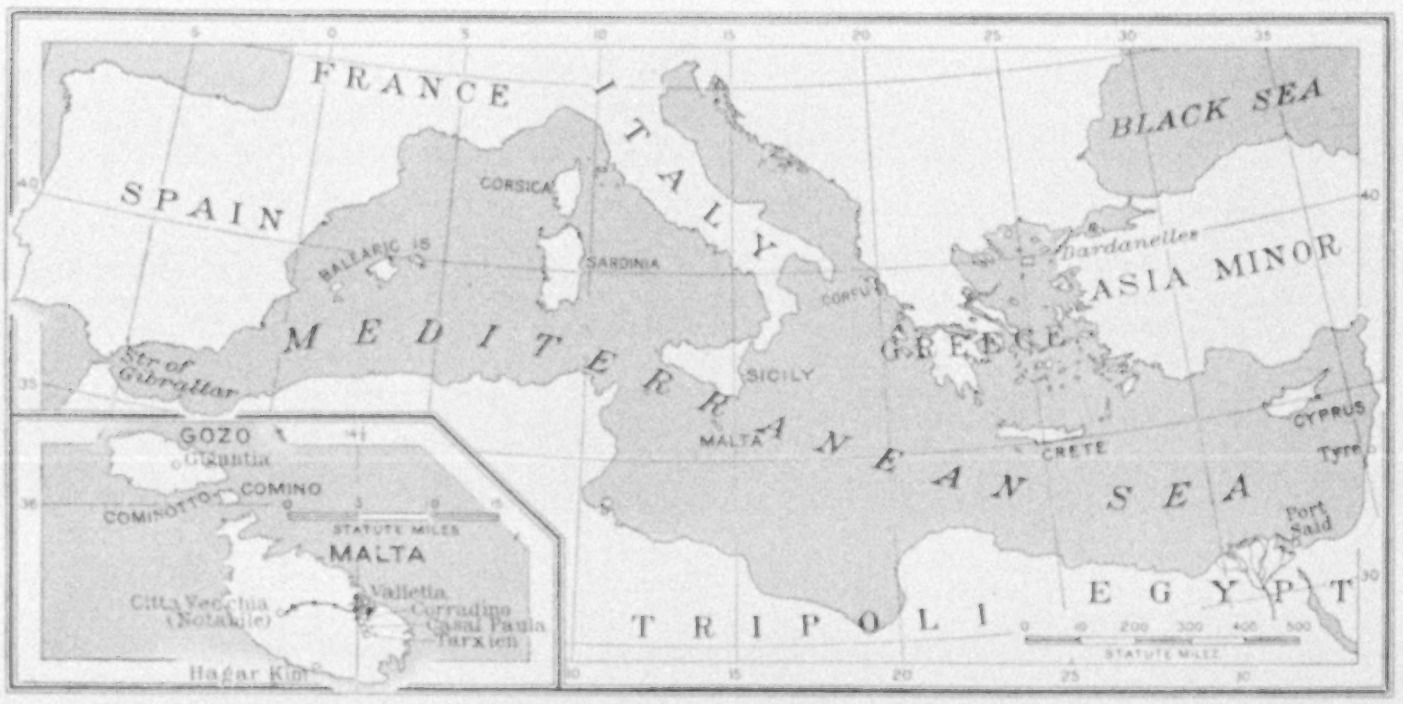
Dimly is seen Africa joined to Spain, Tunis, Sicily, Malta, and Italy, their shores washed by fresh-water lakes in which disported elephant, hippopotamus, crocodile, and land tortoise, until the floods descended and the earth was moved, turning the lakes into salt seas and forming the island of Malta.

PREHISTORIC MEN OF MALTA LEFT THEIR MARK IN CART RUTS

In the caves of Malta, notably that of Ghar Dalam, are to be found the rolled fossil teeth and bones of the great and pigmy elephant, two species of hippo, petrified remains of stag, bear, and wolf, all welded into a solid mass.

As the vertical section of these deposits is examined, there appears toward the top the first signs of man-worked flints, sling-stones, neolithic pottery, and human bones. Thus is found the first trace of man in Malta.

Whether "Drift Man" was ever an inhabitant of Malta is a moot point for academic discussion. In a hilltop excavation, the underground galleries of Hal Saflieni, the ceilings of some of the rooms are covered with red clay paintings of spiral design suggesting a connection with the period of the painted caves of the Pyrenees (see also page 471). It is



A SKETCH MAP OF MALTA, A TINY ISLAND WHICH HAS PLAYED A GREAT RÔLE IN WORLD HISTORY (SEE PAGES 450-454)

established beyond doubt, however, that Malta was inhabited by man before it assumed its present shape.

In many parts of the island where the bare rock is exposed there can be seen deep parallel lines—cart ruts—winding their way quite irrespective of the present centers of abode. Some of the cart ruts lead direct to the cliffs, while others can be traced under an arm of the sea, coming up again on the opposite shore. In other cases the tracks are broken by a geological fault, the ruts continuing on a different level. Many ruts are now covered by several feet of earth, fields having been formed on their sites (see page 455).

In later Stone Age times Malta possessed a considerable population, judging from the wonderful buildings erected in those days. Some have been investigated, but the majority are still untouched.

Beside the magnificent temple of Gigantia in Gozo, Malta possesses the unrivaled erections of Hagar Kim (page 457), Mnaidra (page 459), Corradino, Hal Saflieni Hypogeum (page 459), and Hal Tarxien (page 469), as well as numerous rough stone monuments and altars technically known as menhirs and dolmens.

The extent of some of the prehistoric buildings and the wonderful skill displayed in their erection show that man had reached a high state of knowledge even in the far-off days of B. C. 5000.

From an examination of the skeletons of the polished-stone age, it appears that the early inhabitants of Malta were a race of long-skulled people of lower medium height, akin to the early people of Egypt, who spread westward along the north coast of Africa, whence some went to Malta and Sicily and others to Sardinia and Spain.

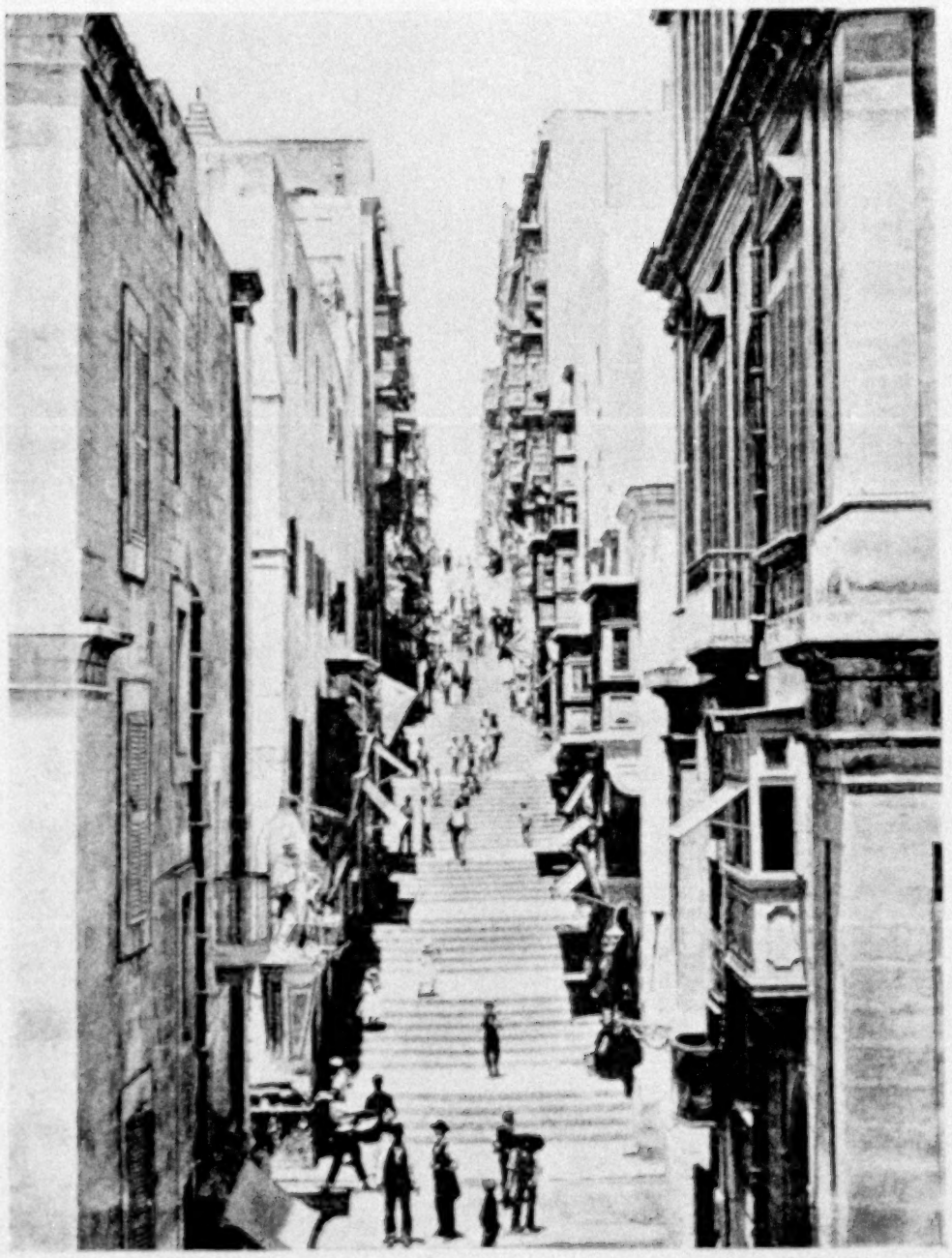
There appears little doubt but that the early Maltese belonged to the same stock as the Iberians of Spain, the Basques of the Pyrenees, the Gauls of France, and the small, dark men of Cornwall, South Wales, and Ireland.*

THE ARRIVAL OF THE PHŒNICIANS

The Bronze Age dwellers in Malta left behind many interesting relics, a burial place having been found on the site of the Stone Age temple of Hal Tarxien, whose ruined walls doubtless provided good shelter for their funeral fires. Numerous urns containing human ashes were found, together with many personal ornaments, the whole providing a very good insight into their belief that the departed were not dead, but merely removed into another sphere, where they required the same food and other necessaries as in this life.

History proper starts in Malta with

* See "The Races of Europe," by Edwin A. Grosvenor, in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1918.



Photograph by S. L. Cassar

MANY OF THE THOROUGHFARES OF VALLETTA, MALTA'S PRINCIPAL CITY, CONSIST OF FLIGHTS OF STAIRS. THIS IS THE STRADA SANTA LUCIA

Perched high upon a peninsula a mile and a half long and a half mile wide, Valletta looks down on the Grand Harbor on the east and on the Marsamuscetto Harbor to the west.

the visits of the Phœnician traders, about B. C. 1500. On the Gigantia at Gozo is an inscription in Phœnician lettering, the usual script in the Mediterranean until the advent of Greek or Latin characters.

The ships of Tarshish found Malta a valuable port of call, and in this fact lay Malta's fate. In common with all islands, its whole prosperity has depended on the good-will of the ruling sea power, from the days of Tyre to the very present hour. Greeks, Carthaginians, Romans, Vandals, Arabs, Normans, Spaniards, Turks—all in succession held power in Malta by reason of their fleets.

It is doubtful if the Punic domination affected the characteristics of the Maltese race, as this was probably only a ruling and trading caste, few in number. It is likely that during this time or in early Roman days the custom of burial in hillside caves was adopted. Thousands of these tomb caves exist. In them is generally found an urn full of broken human bones, with a flat plate placed over the mouth and a clay lamp on the plate. Bottles of food and water were also placed in the tomb. Beautiful glass vessels of iridescent blue, purple, and green are also frequently found in these graves.

The capital of Malta was situated far from the coast—about six miles—on the highest land, the present Notabile. Here, outside the city walls, were excavated the catacombs which extend to a considerable distance. The fact that the sign of the seven-branch candlestick is carved over some of the entrances would suggest a Jewish ownership, but this is open to doubt, as the Jews have rarely thrived in Malta.

WHERE ST. PAUL WAS SHIPWRECKED

At Notabile was the seat of the Roman governor. His residence has been recently excavated and many interesting relics found. In A. D. 60 St. Paul was shipwrecked in the bay now known by

his name, and in the Acts of the Apostles is this account of his stay in the island:

"And when they were escaped, then they knew that the island was called Melita.

"And the barbarous people shewed us no little kindness: for they kindled a fire, and received us every one, because of the present rain, and because of the cold.

"And when Paul had gathered a bundle of sticks, and laid *them* on the fire, there came a viper out of the heat, and fastened on his hand.

"And when the barbarians saw the *venomous* beast hang on his hand, they said among themselves, No doubt this man is a murderer, whom, though he hath escaped the sea, yet vengeance suffereth not to live.

"And he shook off the beast into the fire, and felt no harm.

"Howbeit they looked when he should have swollen, or fallen down dead suddenly: but after they had looked a great while, and saw no harm come to him, they changed their minds, and said that he was a god.

"In the same quarters were possessions of the chief man of the island, whose name was Publius; who received us, and lodged us three days courteously.

"And it came to pass, that the father of Publius lay sick of a fever and of a bloody flux: to whom Paul entered in, and prayed, and laid his hands on him, and healed him.

"So when this was done, others also, which had diseases in the island, came, and were healed:

"Who also honoured us with many honours; and when we departed, they laded *us* with such things as were necessary.

"And after three months we departed in a ship of Alexandria." . . .

St. Paulo and St. Publio are very prominent names in the ecclesiastical history of the island, and to this day the activities of St. Paul in Malta are recited in great detail.

After the fall of Rome Malta became

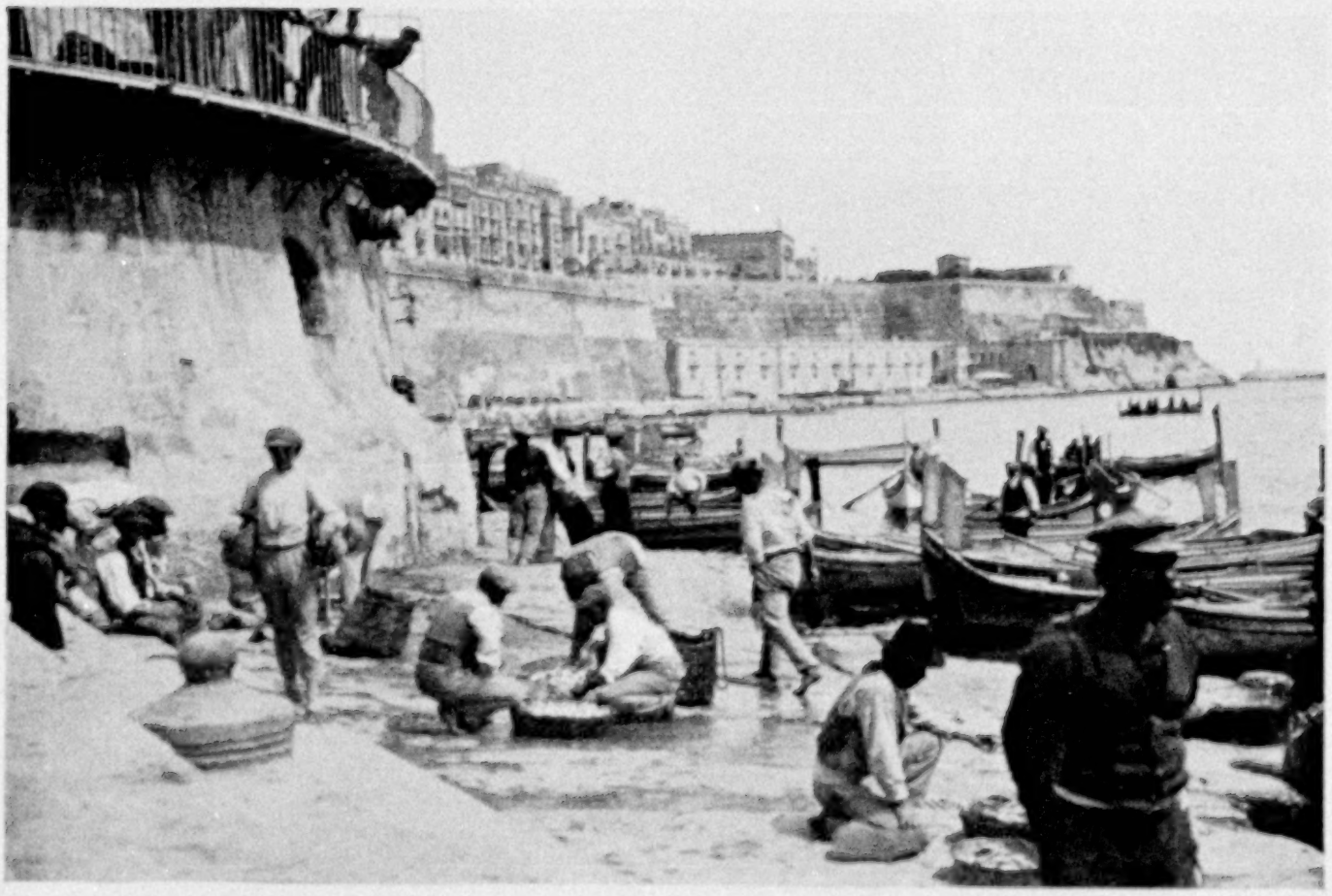
Photograph by A. W. Cutler

A FAMILIAR NAME IN A FOREIGN PORT

"The First and Last Lodging House" may be seen at Valletta, Malta, the name suggesting those inns and road-houses on the outskirts of American cities which formerly intimated by the name "First and Last Chance" that liquid refreshment might be had inside.

FISHING IN THE HARBOR: VALLETTA, MALTA

Malta is only 60 miles from Sicily, 140 miles from the mainland of Italy, and 180 miles from Africa. The cool evening breeze which comes from snow-capped Mount Etna is one of the delightful climatic features of the island.



Photographs by S. L. Cassar

A FISHERMEN'S LANDING PLACE AT VALLETTA

The Maltese are famous throughout the Mediterranean as fishermen, merchants, and mariners. According to a recent census, the fishing industry employed about 3,000 persons operating 900 boats.

subject to various powers, until finally the Arabs, who also ruled Sicily, took possession. While excavating the Roman governor's villa at Notabile several Arab graves were found, all pointing eastward. Their Semitic inscriptions seemed strangely out of place in a Roman ruin. The Arabs built the fortress of St. Angelo, which guards the entrance to the Grand Harbor, on a site formerly occupied by a Roman temple dedicated to Juno.

In A. D. 1090 Count Roger of Normandy, having conquered Sicily, landed at Malta and exacted tribute from the Arabs. An inscribed stone over the entrance to Fort St. Angelo records the Norman victory, and several beautiful Norman buildings are still to be seen at Notabile.

The Arabs finally left Malta about A. D. 1250, having exercised rule over the island for nearly 400 years, doubtless facilitated by their language, which is closely akin to Maltese.

During the next three centuries Malta did not figure largely in history. It lacked agricultural resources and was periodically ravaged by the commanders of Turkish fleets, who dragged the unfortunate inhabitants into slavery, while famine and plague often followed in their wake.

In 1530 the population of the island did not exceed 25,000 and was probably considerably less.

THE BIRTH OF THE ORDER OF ST. JOHN

In that year a great change occurred. Charles V of Spain granted the islands of Malta and Gozo, together with the town of Tripoli, in Africa, to the Order of St. John of Jerusalem, afterward known as the Knights of Malta.

In the early 11th century a pilgrimage to the holy places at Jerusalem was a very arduous and dangerous undertaking and many pilgrims died from exhaustion. A hospital was founded about 1085 at Jerusalem for the use of pilgrims and was dedicated to St. John. To meet various requirements, the hospital was reorganized and an Order instituted, consisting of ecclesiastics, to administer to the spiritual wants of the pilgrims, lay brothers for secular duty, and knights for defense and protection.

After the capture of Jerusalem by the Saracens, Crusaders from all kingdoms of Christendom hastened eastward and the Knights of St. John, then installed at Acre, added members of many nationalities to their number. In 1252 the Pope granted the title of Grand Master to the head of the Knights.

For general convenience, the Order was divided into subdivisions according to the principal languages spoken by its members. The sections of the Order were the "Langues" of Provence, Auvergne, France, Italy, Aragon, Catalonia, Navarre, England, Germany, Castile, Leon, and Portugal. The Langue d'Angleterre was dissolved in 1540, at the Reformation. An Anglo-Bavarian Langue was reinstituted in the 18th century.

Each Langue had its own headquarters, or "Auberge," and those built at Malta are monuments of architectural beauty. They are now used chiefly as government offices and during the World War were scenes of intense activity.

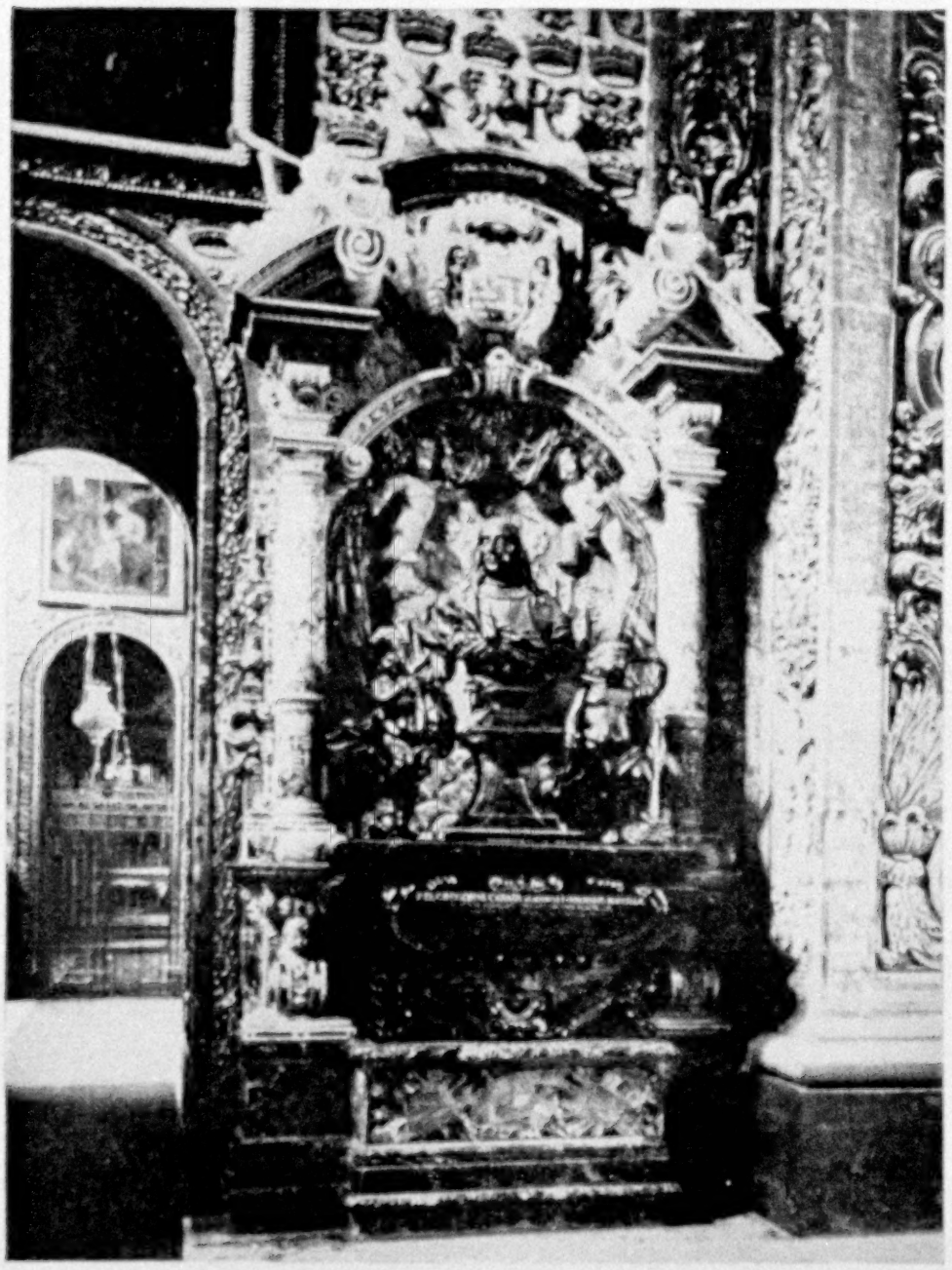
THE TURKS DEFEATED BY LA VALLETTE

The Order removed from Acre to Cyprus and thence to Rhodes, where its headquarters remained until the island's fall, in 1522.* The old bond between Rhodes and Malta was commemorated by the Pope, who gave the Bishop of Malta the title of Archbishop of Rhodes.

In 1565 the Turkish fleets made a powerful attack on Malta, but were finally defeated by Grand Master La Vallette, who built the city of Valletta in memory of the victory. The Cathedral of St. John, in Valletta, was also built as a burial place for the Grand Masters, the remains of those previously interred in the Chapel of Fort St. Angelo being transferred.

In the latter part of the 18th century the Langue de France was the richest and most powerful section of the Order. Lack of military enterprise and luxurious living, however, sapped the power and prestige of the Knights, who were cordially hated by the Maltese. The French Revolution at one blow deprived this

*See "Historic Islands and Shores of the Ægean Sea," by Ernest Lloyd Harris, in the NATIONAL GEOGRAPHIC MAGAZINE, Sept., 1915.



Photograph by W. A. Griffiths

TOMB OF GRAND MASTER CARAFA IN ST. JOHN'S CHURCH, VALLETTA: MALTA

This cathedral was built in 1573-77. The interior was elaborately decorated as the Temple of Fame for the Order of the Knights of St. John. The chapels were dedicated to the nine nations of the order (see page 453).

Langue of most of its revenue, and a similar fate soon befell the other sections.

In the course of the next few years the Order sank and for a time dwindled into oblivion. The Order still exists in England and works in conjunction with the St. John's Ambulance Society and British Red Cross Society, all of which rendered magnificent service during the World War.

In 1798 the wheel of Fate again brought Malta into prominence. Napoleon, profiting by the temporary absence of the British fleet from the Mediterranean, seized the island on his way to Egypt. He expelled all members of the Order, confiscating their property and also that of the Church.

It is related that the solid silver gates of the Sacramental Chapel of the Cathedral of St. John were hastily painted over, in the hope of escaping notice, but in vain. They were, however, redeemed at a great price, together with the twelve silver statues of the Apostles.

HOW THE HISTORIC CROZIER WAS SAVED

The historic crozier that had been brought from Rhodes escaped the enemy by being thrown into a cistern by the verger. The priests afterward accused the verger of having stolen it, refusing to believe his statement; but even on his deathbed he persisted in his story, and so the cistern was drained and the crozier found.

After Napoleon's departure a governor was appointed to rule on behalf of the French Republic. Soon afterward the British fleet returned and won the Battle of the Nile over the French. Then the Maltese arose against the French garrison, which was blockaded by the British. After a gallant defense, lasting two years, the garrison finally was forced by famine to surrender.

After peace came Britain proposed to restore the island to the Order of St. John, but the piteous appeals of the Mal-

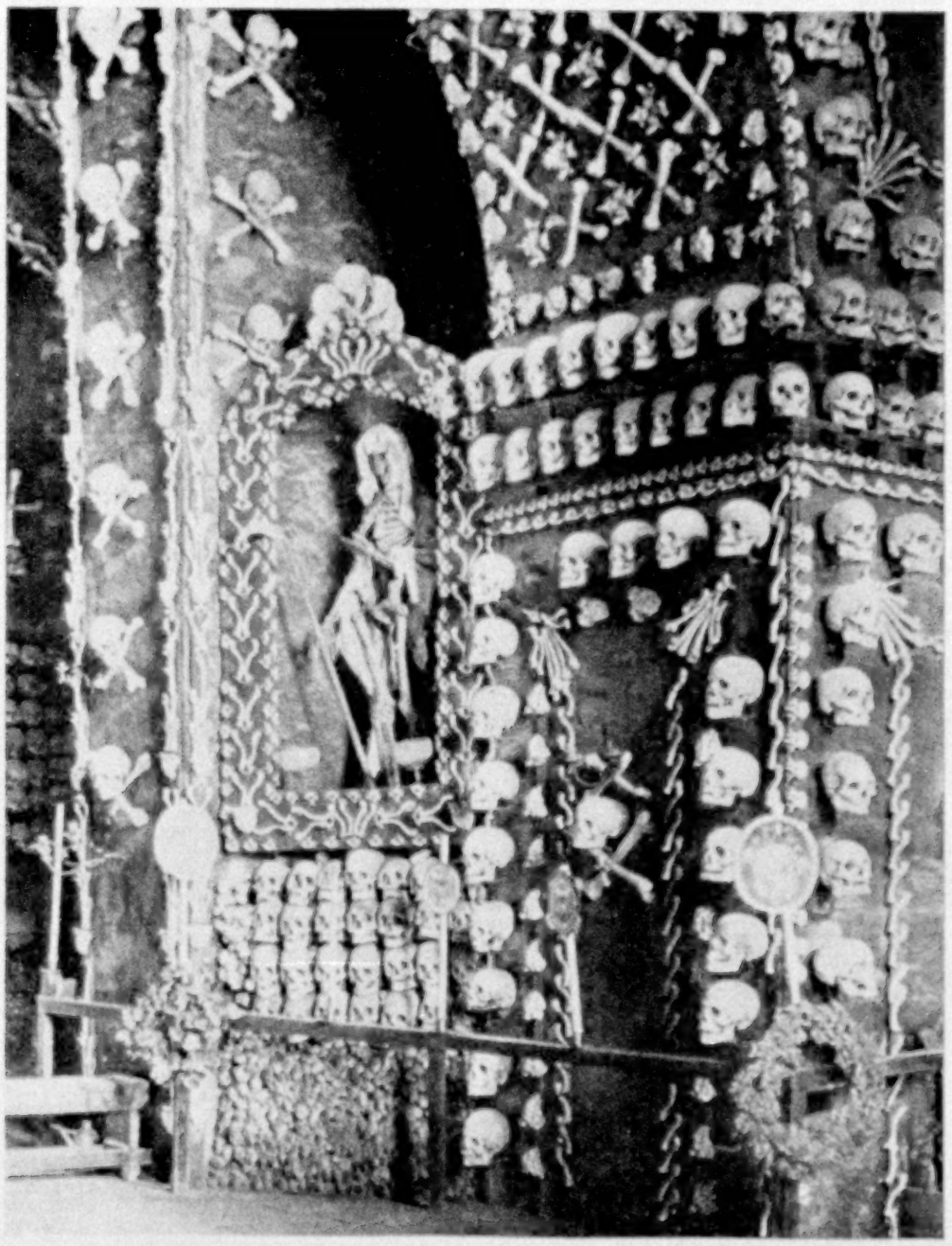
tese at last prevailed and Malta became incorporated into the British Empire — a very happy decision for its inhabitants.

Year in, year out, fresh trade has flowed through Malta, at last secure from every foe. The ships of the world soon thronged its harbors.

In 1825 the famous American frigate *Constitution* anchored at Malta, while after the battle of Navarino, in 1827, the British, French, and Russian fleets returned there also.

The change from sail to steam necessitated the provision of greater dockyard facilities for the British fleet in the Mediterranean, and millions of dollars have since been spent in Malta for this purpose, bringing employment and trade to the Maltese such as they had never known before.

The opening of the Suez Canal brought still further prosperity, while the increased size of warships necessitated further new docks and workshops, providing still more employment for the skillful and industrious inhabitants of the island.



Photograph by A. W. Cutler

THIS MALTA MORTUARY HAS FOR ITS MURAL DECORATIONS MORE THAN 2,000 HUMAN SKULLS

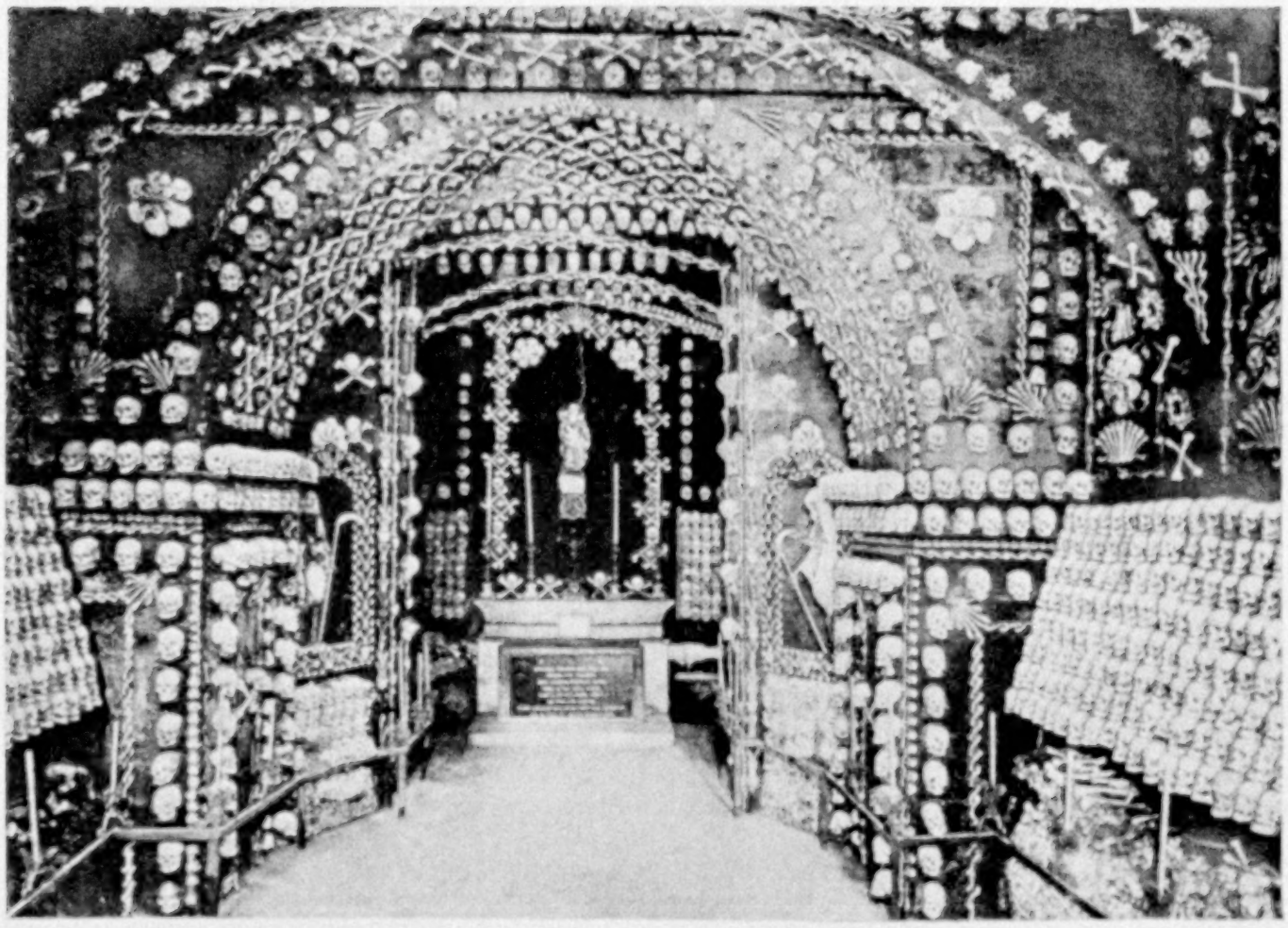
These grim relics belonged to the defenders of the island who were killed by the Turks in the 16th century.

BAFFLING EVIDENCE OF A REMOTE CIVILIZATION

Reference has been made in the preceding pages to the wonderful prehistoric remains in Malta. These are extremely abundant and afford much tangible evidence of the civilization of a past so remote as to be prior to the age of hieroglyphics and inscriptions and even of oral tradition. Their study, therefore, affords wide scope for theory, but the lack of absolute knowledge renders it a most tantalizing, though fascinating, pursuit.

Possibly the oldest existing evidences of civilization in Malta are the cart ruts previously mentioned. These exist in nearly every part of the island, cutting and intersecting each other to such an extent as to make the student almost despair of ever unraveling their mystery. If all the old tracks were traced and inserted on a map, the sites of the centers of habitation in prehistoric times would doubtless be revealed (see page 449).

In an arm of the Bay of Marsa Sci-



Photograph by S. L. Cassar

THE CHAPEL OF BONES IN VALLETTA: MALTA

Malta not only has ruins in which prehistoric man buried his thousands, as at Hal Saflieni, where the remains of 33,000 persons were found, but also such chapels as this, where the bones of the knights of the Middle Ages are preserved.

rocco, at the southeast end of the island, there are about sixty round, bottle-necked pits or wells cut out of the foreshore rock. A number of these are now under the sea. Directly over the mouths of some of them run two deep ruts, which lead into the sea and reappear on the opposite shore about a quarter of a mile away.

STORAGE WELLS FOR OIL OR WATER

The original purpose of these wells is not known, but it has been suggested they were intended for storing fresh water, grain or oil and were built at the edge of the water for convenience of shipment, thus suggesting evidence of foreign trade.

Black tufa stone rubbers were imported from Sicily and obsidian from the Greek islands has also been found. Similar pits, however, are found at the top of the high cliffs near a prehistoric village called Bahria.

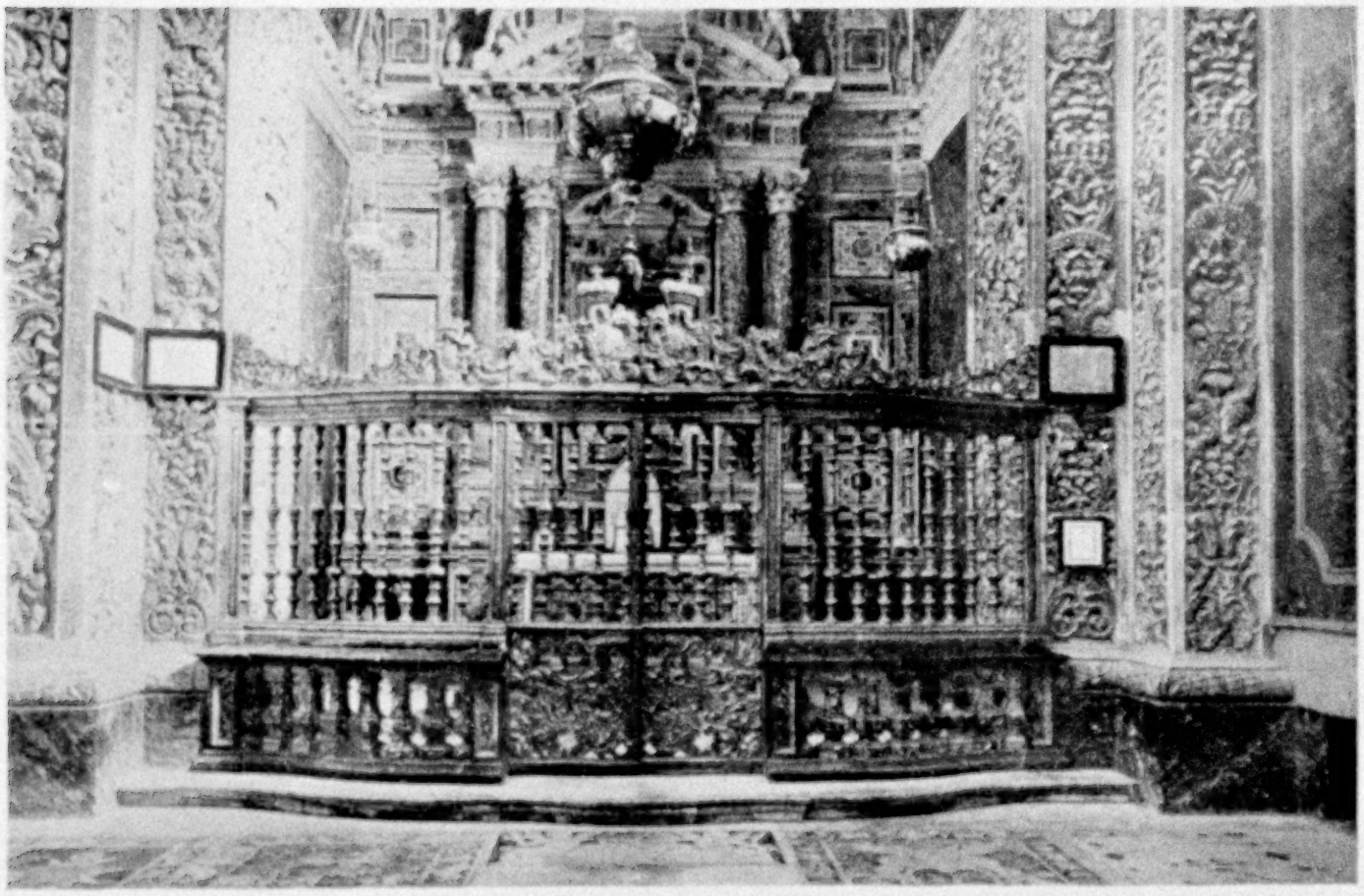
Near this site is a megalithic ruin called Borg en Nadur, which recalls in shape those curious Sardinian towers, the nuraghi,* and the cart tracks appear to lead from that place to another neolithic erection on the opposite shore.

Possibly the Phœnicians utilized the Stone Age erections for their own sacrificial purposes, as a votive pillar was found in this neighborhood having an inscription in two languages, recording in Phœnician a vow to Melkarte, Lord of Tyre, and one to Hercules Archigetas in Greek.

The prehistoric remains consist chiefly of temples, villages, dolmens, menhirs, storage places, and tombs.

The best-known temples are Gigantia, in Gozo, the small island four miles northwest of Malta, and Hagar Kim, Mnaidra, Corradino, and Tarxien, in Malta (see also page 473). The last

*See "Little-known Sardinia," by Helen Dunstan Wright in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1916.



Photograph by W. A. Griffiths

THE SOLID SILVER GATES OF ST. JOHN'S CHURCH: MALTA

When Napoleon stopped at the island on his way to Egypt he expelled the Knights of Malta, confiscating their property and that of the Church. These silver gates were hastily painted, in the hope that they would escape notice, but in vain. They were subsequently redeemed at a great price.

named was discovered very recently and is only partly excavated. The unique underground temple of Hal Saflieni belongs in a class to itself.

THE GENERAL DESIGN OF MALTA'S PREHISTORIC TEMPLES

The general design of the temples consists of two oval or elliptical apses connected along the lesser axes by passages, at the far end of which is generally found the principal altar or object of worship.

The passageways appear to have been covered over with flat slabs and the oval chambers on each side domed, the corbeling of the walls being very strongly marked.

The compass direction of the passages leading to the principal altar varies in each temple, which was built to suit local topography. There does not appear to be any evidence of orientation or suggestion that the altars faced any special heavenly body. The majority face south or southeast.

The ruins of Hagar Kim ("Standing Stones") crown a barren, rocky hill on the south side of Malta, about a mile from the shore. The little islet of Filfla alone breaks the wide expanse of deep Mediterranean blue.

Large numbers of massive stones, some weighing several tons, were placed on end, side by side, each being joined to the next with great skill. On top of these were placed horizontal layers of flat stones, mortised together with great accuracy.

One pillar rises conspicuously above the ruined walls. Near it, on the outside, is an altar erected before a sacred stone, while a small hole pierces the wall to communicate with an inner sanctuary and through which the priest or priestess possibly consulted the oracle.

The top of the tall pillar is hollow and shaped like a grave, and theorists suggest that possibly here infants were sac-

A CHURCH IN MALTA READY FOR ITS FEAST DAY ILLUMINATION

Note the hundreds of electric-light bulbs in elaborate design on the façade.

Photographs by S. L. Cassar

A RELIGIOUS PROCESSION IN MALTA

The Maltese are deeply attached to the Church of Rome, and it is said that in no other community of equal size are the religious edifices so numerous and so beautifully decorated. The first Christian bishop of the island, legend tells us, was Publius, whom Paul converted.

rificed or the dead exposed to birds of prey, as is done in the Indian Towers of Silence.*

STONE FIGURES WITH PLAITED SKIRTS

When Hagar Kim was explored various interesting relics were found. One was a four-sided pillar with a flat, round top, possibly a sacramental altar. Each side is decorated with pittings at the edges, while the centers contain carvings of a many-leafed plant growing out of a vase. This decoration may represent the Tree of Life.

The most remarkable find consisted of seven stone carved figures of steatopygous females, some draped with plaited skirts and others apparently nude. Possibly they were originally painted entirely red, as red ocher paint is still largely visible.

One figure has a sort of pigtail behind, which might also have served as a handle to permit the image to be carried in a procession. None of them had heads, although sockets were found into which detachable heads could be fixed.

These figures suggest that they were worshiped as the Mother Giver of Life. They are sometimes described as the Seven Cabiri of the Phœnicians, to which nation all Maltese antiquities and even the race itself were until recently ascribed. Subsequent discoveries have proved beyond doubt, however, that these images were of neolithic age.

THE MALTESE LANGUAGE HAS NO WORD FOR "FATHER"

In connection with the worship of Matriarchy, it is curious to note that the Maltese language contains no word for "father" which conveys the idea of a head of a family. Their word "missier" literally means "instrument of generation" and suggests the time when descent was reckoned maternally rather than paternally.

About half-way between Hagar Kim and the shore is the neolithic ruin of Mnaidra. This resembles in general plan Hagar Kim, but is rather more ornate and better preserved. Many of the doorways and altar stones are decorated with pittings or are finely polished. This doubtless accounts for its local name of the "King's Palace," Hagar Kim being called the "High Priest's Palace."

A special feature of Mnaidra is the double-table altars. These are flat rubbed stones a yard or two square, supported under the center by a stone pillar. The largest is called the "King's Bed," certainly a couch stony enough to insure an uneasy royal head.

Both at Hagar Kim and Mnaidra it is evident that dolmens were regarded as objects of special veneration. They may have represented the gates from this world to the next, through which all must pass, or they may have typified the abodes of the departed spirits.

A dolmen grave at Borg en Nadur has the lintel or upper cross-stone pierced in the center by a round hole, used perhaps in a sacrificial ceremony, so that the blood of the victim might fall on the occupant of the grave. Dolmen graves with a hole in the side wall-stone are much more common.

Near Mnaidra is a cave in which the remains of a peculiar kind of elephant were found, to which the name *Elephans Mnaidrensis* was given.

WELL-DIGGERS FIND A TEMPLE

The Corradino neolithic station stands on a broad plateau overlooking the Grand Harbor. The ruins are very extensive, consisting of several temples and a village. The ruins of the latter are distinguishable by being square instead of oval in shape, like the temples.

On the southern boundary of Corradino is the village of Casal Paula, which overlooks the broad, flat plain of the Marsa. In 1902 a well was being bored for some newly erected houses, when suddenly the foundations gave way and the whole disappeared into a dark pit. Investigation resulted in the discovery of an underground habitation which is without equal in the world.

This hypogeum, or subterranean structure, now known as Hal Saflieni, consists of three series of chambers excavated out of the solid rock, on three levels. It stood in the midst of a neolithic village.

* See "The Parsees and the Towers of Silence at Bombay," by William Thomas Fee, in the NATIONAL GEOGRAPHIC MAGAZINE, December, 1905.

MALTA CLAIMS A MILCH-GOAT POPULATION OF 10,000

Since Mediterranean, or Malta, fever has been traced to a micro-organism to be found in the milk of these perambulating "dairies," the goat boy is not as popular with visitors as he was in olden days.

Photograph by S. L. Cassar

HONEY MERCHANTS OF MALTA

The island was famous for its honey in ancient times, the name itself coming from the Greek word "Melita," meaning honey. In the Biblical account of Paul's shipwreck the name of the island is given as Melita (see text, page 451).

THE COUNTRY ROAD LEADING TO CITTA VECCHIA, THE FIRST CITY REBUILT BY THE KNIGHTS OF MALTA

Malta and the neighboring islands of Gozo, Comino, and Cominotto have a combined area of 118 miles, with a teeming population of 225,000. The fields of the islands are small and consist largely of terraces, the soil being walled up along the slopes of hills.

Photographs by S. L. Carsar

THE WATER-WAGONS OF MALTA HAVE TAIL-LIKE APPENDAGES

The operator walks in the rear of the cart and waves the sprinkler back and forth, thus covering the space between the curbs.

THE SOLE RELIC OF THE OLD NATIVE COSTUME IS THE PECULIAR BLACK HEADDRESS OF THE WOMEN, CALLED THE "FALDETTA"

The Maltese are a thrifty, industrious people. The women are noted for their black eyes, fine hair, and graceful carriage.

Photographs by S. L. Cassar

A REAR VIEW OF THE MALTESE EASTER BONNET

While farming is the principal industry in Malta, more than 5,000 women and children are engaged in producing the famous Maltese lace.

Two large upright stones mark the entrance below ground and near by was found a large quantity of heavy sling-stones, conveniently ready for use in case of emergency.

Drilled in the threshold floor are two holes the bottoms of which connect. Through the loop thus formed was passed a rope to tether the animal chosen for sacrifice. A large cave near at hand apparently was used as a pen for animals, the top being so low that a man could not stand erect in it.

Proceeding down the entrance passage, which is of course absolutely dark unless lit artificially, we notice on the left a round, well-like excavation. At first it appears to be an ordinary pit, but on closer examination a second inner well is seen, the top of the latter being closed by a tightly fitting lid. This was evidently used for special security. In it were found two stone figures of steatopygous figures similar to those found at Hagar Kim. The figures also had detachable heads, both of which, fortunately, were found.

Continuing, we pass a side cave now packed with human bones. At the entrance is a circular stone basin with a hole bored in its center and covering another pit which would form an ideal dungeon.

The passage finally narrows to a large dolmen-shaped doorway, and through this we pass to a lower floor, with a sudden drop of several feet. The absence of steps to the different compartments is puzzling, as it is open to doubt whether perishable wooden ones were provided when stone was available.

THE MYSTERIOUS MAIN HALL OF THE TEMPLE

We have now reached a long, silent cave which must have looked very weird when lit by a few hanging pottery lamps. In the center is a large upright stone.

Proceeding to the left, we climb a stone wall a yard high, also without steps, and pass through a doorway into a large circular cave which appears to be the main hall of the temple. At once the attention of the eye is called to a doorway carved out of the end of the cave at a height of several yards from the floor.

The doorway leads to a small oval cave at the back. On both sides are niches each of which probably contained a sacred pillar or other object of worship. Here the carving is beautifully worked and polished. Four other doorways lead to caves on the level of the floor. The general appearance of the niches suggests that the lower ones were excavated later and less carefully than the upper ones.

The ceiling of the room is decorated with ocher paint, partly in plain red and partly in squares alternately black and white.

THE HOLY OF HOLIES

Passing out of this room through a doorway erected on a step a yard above the floor, we come to what is called the "Holy of Holies," the upper portion of the room being carved and polished very ornately (see page 468).

A small room to the rear contains a stone table, over the middle of which is carved a stone hook from which some sacred object or sacrifice or possibly a lamp was suspended. The doorway of this little room has grooves for fitting a closing slab, but this would also shut out the air and the occupant would soon die of suffocation. It is remarkable that the "Holy of Holies" is the only room not decorated with paint.

In the illustration (see page 468) may be noticed a hole in the right-hand curved support, while another is near its foot. The left-hand upright of the entrance is also bored with a tie-hole. From these three places it is supposed a curtain or screen was hung to hide the holy p'ace from the sight of persons using the steps leading down to the lowermost rooms.

In the floor, in front of the left niche, are two holes closed with plugs flush with the ground. In the right hole two pairs of ram's horns were discovered, doubtless having some religious significance.

Retracing our way from the Holy of Holies through the main hall to the room containing the large upright stone, or menhir, and turning to the left, we proceed toward another set of caves. It will be noticed that in this passage the rock, instead of sounding solid to the tread, suddenly sounds very hollow, as if there were a well or room not yet opened.

XUM

Photograph by S. L. Cassar

THE IMTARFA BARRACKS AND THE NOTABILE RAILWAY TERMINUS (IN THE FOREGROUND): MALTA

Notabile, or Citta Vecchia, is seven miles inland from Valletta, and is still popularly known as *Medina* (Arabic for town). In Roman times this city was the fortified capital of the island. According to legend, it was here that St. Paul dwelt during his three months' stay on the island, following his shipwreck.

What wonderful store of archæological wealth is perhaps here awaiting that opening!

The walls along the right of this passage are full of drill-holes an inch or less in diameter. This shows the method of excavation employed. Holes were drilled with flint points and the intermediate portions chipped away with stone hammers or chisels, several fine specimens of which were found.

Continuing along this passage, we come to another room, into which we enter with a sudden drop of a yard. Looking through the entrance doorway, the wall on the left appears quite straight at first, curving round at the end, while the right wall is very much sloped.

Descending some modern stone steps, a round recess on the left is seen. In this place a person could stand without being observed by any one approaching along the passage, while a spy-hole is provided for the use of the occupant of the recess. Two holes are also bored in the walls of the recess to spy into the adjoining cave.

AN ORACLE CAVE AND A SOUND-MAGNIFYING CHAMBER

Passing the recess, we come to a square entrance into a small round cave a yard or two in diameter. Possibly the oracle was kept here. A little farther in the cave, at about the level of a man's mouth, is a hemispherical hole in the side wall about two feet in diameter. Here it was noticed only a few months ago that any word spoken into this place was magnified a hundred-fold and audible throughout the entire underground structure.

A curved projection is specially carved out of the back of the cave near this hole and acts as a sounding-board, showing that the designers had a good practical knowledge of sound-wave motion. The impression upon the credulous can be imagined when the oracle spoke and the words came thundering forth through the dark and mysterious places with terrifying impressiveness.

Before leaving the oracle room, special notice must be taken of the wonderful ceiling paintings, which are the finest in the temple. Possibly the design of the spirals and disks may have some mystic meaning in connection with the passing of the human soul through various cycles.

THE PIT OF SERPENTS?

Proceeding to the next room, a distant view of the Holy of Holies is obtained. This anteroom has several curious features. The roof is supported—quite unnecessarily for structural requirements—by two menhirs differing in design. The one to the right is similar to the sacred pillars at Hagar Kim (see page 457) and to the high altar of Tarxien (see page 477).

On the left is a mysterious pit. The low stone wall on the left is grooved to receive an upper stone, thus increasing its height. The pit is shaped like a funnel, with a curious slip-way worn out just below the hole in the opposite wall which communicates with the main hall.

After sloping downward and inward, the pit widens considerably and is sufficiently deep to prevent even a tall man from climbing out. It has been thought that sacred serpents were kept in this pit, the curving sides of which would prevent their escape. Possibly after the serpent had been lifted up, as was done by Moses in the wilderness, and due worship made, it would be returned to its lair through the hole in the wall. The larger entrance on the opposite side would permit of a man or woman being cast among the serpents to be stung to death.*

Passing to the right of the pillar and then sharply turning to the left, we descend a very finely worked series of seven steps into the lowest and innermost rooms. These steps are erected on the lintel of a huge dolmen. Opposite the lowest step and isolated by a deep moat-like trench is a small inner cave wherein a priest or vestal might have sat and communed.

There are no steps to this small room and it is difficult to reach. On its right hand is a small spy-hole, through which all persons at work in the moat can be seen. Adjoining the moat and divided only by another doorway are several

* See also an account of the serpent pits in the temples of the Incas, in "The Wonderland of Peru," by Hiram Bingham, NATIONAL GEOGRAPHIC MAGAZINE, April, 1913.

A STONE AGE TEMPLE SHOWING SACRIFICIAL TABLES IN THE FOREGROUND: MALTA

Massive stones, some weighing several tons, are placed on end side by side, each being joined to the next with great skill. On top of some of these are horizontal layers of flat stones accurately mortised together (see text, page 457).

similar compartments, the last being situated almost directly under the serpent pit. The innermost room of all has four openings about a foot square leading to four tiny caves, which might have been used as places for the deposit of treasure.

This completes the itinerary of the temple, which is so complex that one can only speculate as to the use or significance of its many extraordinary features.

A MAUSOLEUM FOR 33,000 PERSONS

In 1906 the work of exploration was begun. Most of the rooms were found to be half-filled with earth, human bones, and broken pottery. It has been estimated that the ruins contained the bones of 33,000 persons, mostly adults. Practically all were found in the greatest disorder, and there had evidently been no regular burial of a complete body.

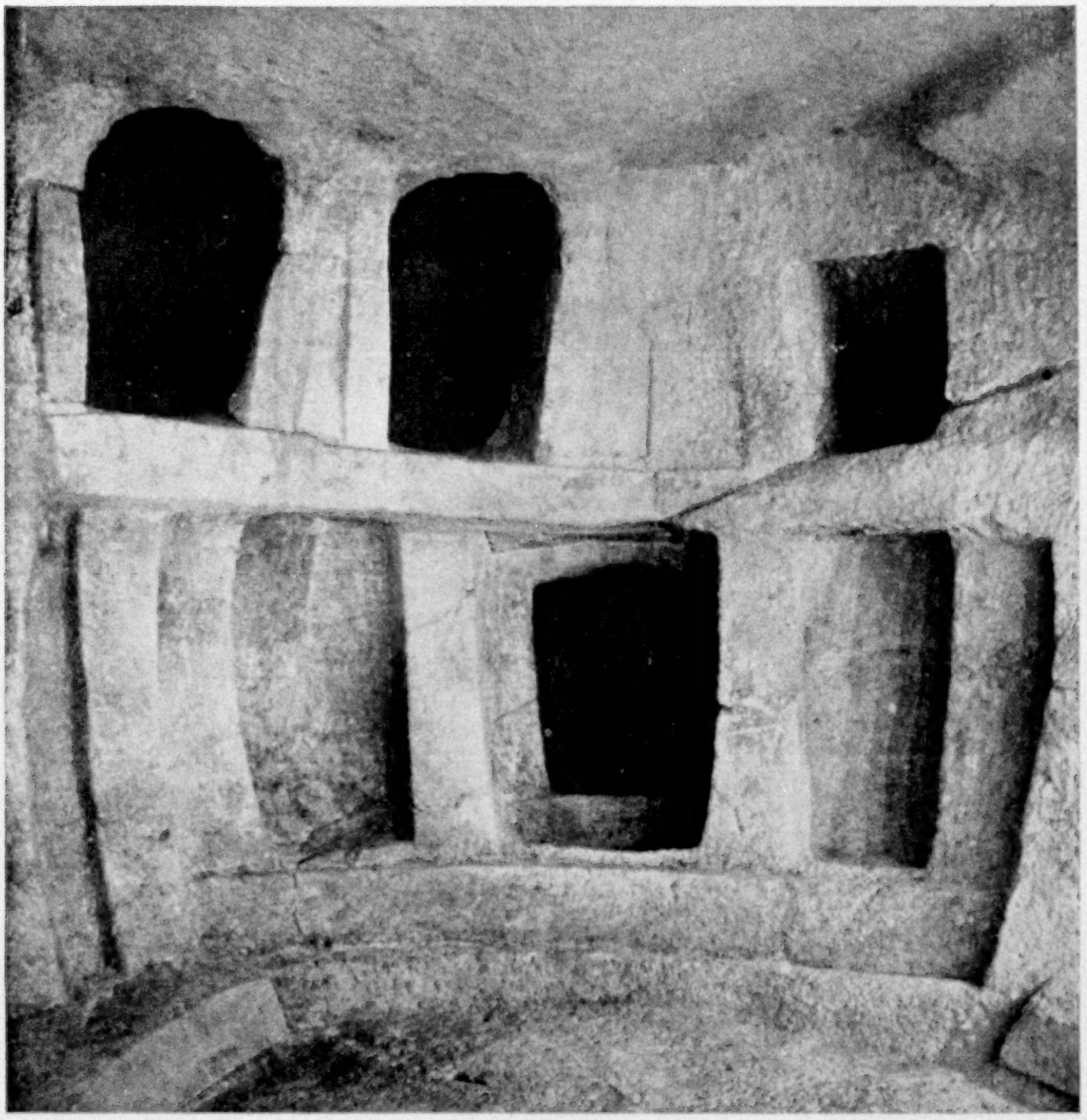
With regard to the original use of the hypogeum, opinions vary. It may be that it was a temple carved underground for the use of spirits who had left this world, providing them with the same type of temple as that in which they had been accustomed to worship above ground; or it may have been a sacred college, wherein the priesthood were initiated into the mysterious beliefs of those days.

CURIOUS FINDS AMONG THE BONES

Whatever may have been the original use, there is no doubt that it was used in part as a burial place for the bones of the dead after a previous burial above ground.

A large number of personal ornaments and votive offerings were found mixed with the bones, and these afford much insight into prehistoric beliefs and customs. Besides the large stone female figures already mentioned, several tiny alabaster replicas were found.

A small carving was also found of a woman with a small head and large lower figure, lying on her side asleep on a four-legged couch. Her head is placed on a shaped neck-rest. The figure is clad in quite fashionable flounces and plaitings and was evidently painted red.



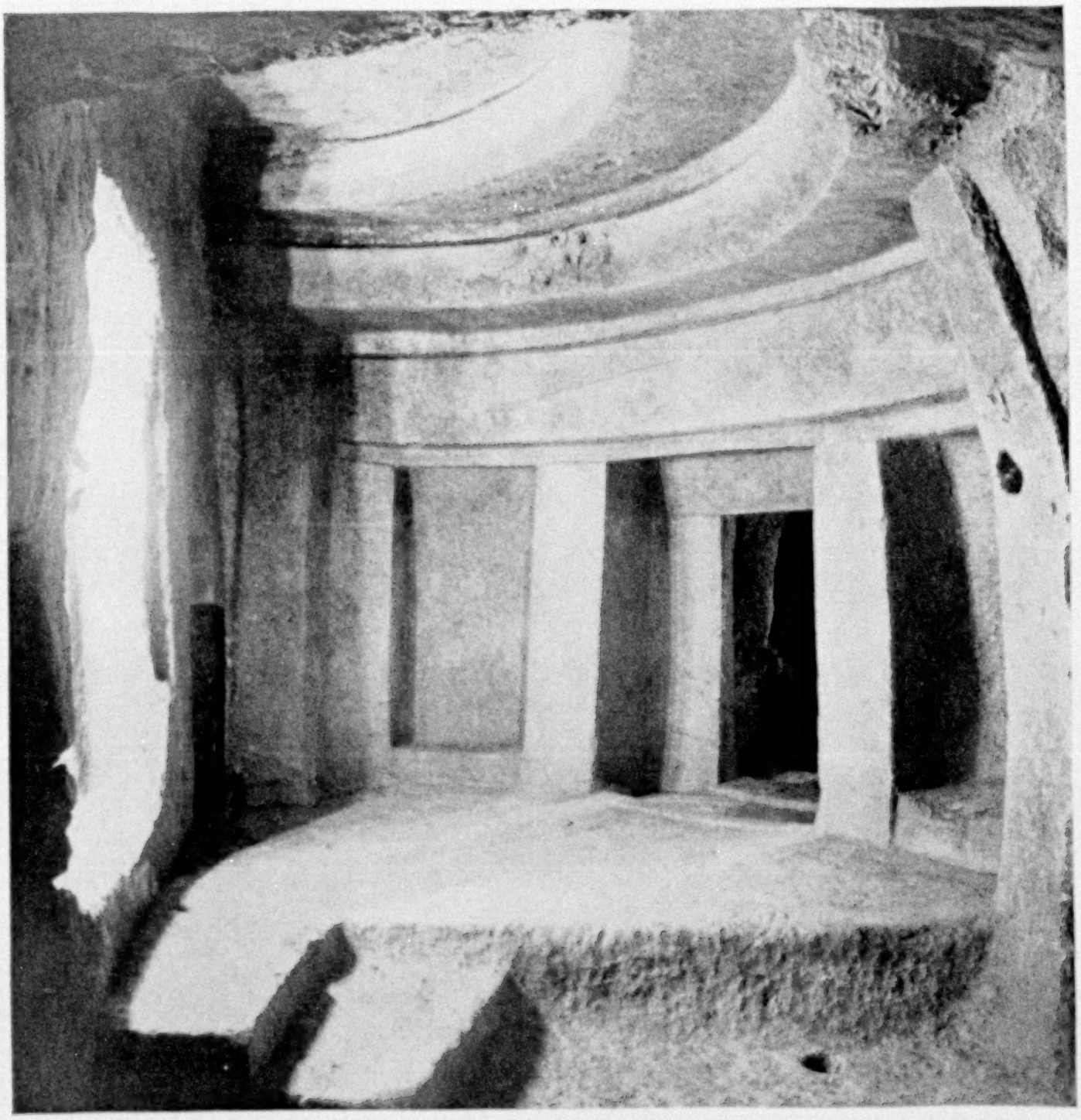
THE MAIN HALL OF THE TEMPLE OF HAL SAFLIENI: MALTA

Four doorways lead from this chamber to caves on the level of the floor (see text, page 463).

Another carving shows a woman, similarly clad and proportioned, lying face downward on her couch, her hands stretched forward on either side. It is suggested that the former represents a priestess dreaming near the sacred places in the hope of obtaining inspiration to declare the words of the holy oracle, while the second figure represents her in the act of worship.

A large number of axe-shaped pendants of jade or polished stone were found, suggesting some connection with the symbolic axe worshipers of Crete. Two objects representing fish were found, one being placed on a plate. Doubtless the fish was venerated as an emblem of the Giver of Life, and possibly the adoption of a fish as the sign of a fellow-Christian in the Catacomb days of Rome was the survival of an old belief. Today in Malta fish is usually eaten on the first night spent in a new house, to bring good luck.

Symbolic stones carved into the shape of sea shells, votive lamps, real sea shells, vertebræ of fish, artificial seeds, cones, tiny pillars, large spheres, and holed



THE FAMOUS HOLY OF HOLIES IN THE SUBTERRANEAN STRUCTURE KNOWN AS THE HYPOGEUM OF HAL SAFLIENI: MALTA

One of the remarkable features of this great chamber is the entire absence of any mural designs. This is the only room not decorated with paint. A curtain or screen is supposed to have hung before this holy place to conceal it from persons using the steps leading to lower chambers (see text, page 463).

stones were found in abundance, doubtless all having some special significance.

BEAUTIFUL POTTERY, IN EVERY INSTANCE SHATTERED

Much beautiful pottery was found, practically all broken. This may have been intentional, as typifying the snapping of the thread of life. The pottery varied in kind from rough clay vessels to finely polished and glazed ware, ornamented with spirals worked with flints. Some bore bright lines of red ocher of artistic design.

Perhaps the most interesting piece of pottery found was a black polished plate, on which was drawn with flint the figures of several large horned bulls of mottled color, all instinct with life. The species of animal was identical with that carved

in high relief in the "bull sanctuary" of the latest and most wonderful discovery of all, the Stone Age Temple of Tarxien.

A CEMETERY FOR CRIMINALS LEADS TO AN ASTOUNDING DISCOVERY

Tarxien is a continuation of the village of Casal Paula, where the hypogeum of Hal Saflieni is situated. It owes its discovery to the following circumstances:

A few years ago it was necessary to find a new burial place for criminals, and a site was selected on the plateau overlooking the dockyard from the southeast. While digging the foundations for the cemetery chapel the earth was found to have been artificially deposited, as it contained blocks of hand-wrought masonry. The workmen, talking among themselves, elicited the fact that in the adjoining field large blocks of stones had also been struck a few feet below the level of the soil.

As the work of excavating the hypogeum in the village was still fresh in their minds, the laborers thought possibly a similar structure might exist here.

The facts were reported in 1913 to Prof. T. Zammit, C. M. G., who had supervised the final excavation of the hypogeum. In July, 1915, he caused the blocks to be cleared of soil. They were found to be the tops of the walls of a prehistoric temple of the same shape as those of Gigantia, in Gozo, and Hagar Kim and Mnaidra, in Malta.

WAR FAILS TO STOP RESEARCH

The work of excavation was carried out during the hottest months of 1915 and 1916, when the soil was driest, so that it could be carefully sifted to prevent the loss of the smallest objects which might be of interest.

Here, despite the tropical sun, a small band of students, among whom was the writer of this article, labored under the able and genial guidance of Professor Zammit.

The drain of war expense on the funds of the Malta civil government permitted only a very small expenditure of money on this work during 1917 and 1918, but it was sufficient to show that the temple and its precincts extended beyond its present known limits and where secrets unknown as yet to the world may still lie hidden.

The examination of the upper layers of earth over the site of the temple brought to light quantities of Roman and Punic pottery, practically all in fragments.

A lower layer revealed a new type of pottery, among which were found small heaps of burnt human bones. Beads, necklaces, clay objects representing birds, fishes, &c., small figures, bone ornaments, and a bronze dagger were found in this same layer. The dagger gave the clue to the mystery—a Bronze Age depository of funeral urns had been found.

This was very valuable, from the light it shed on the life and customs of the Mediterranean Bronze Age people, who probably flourished about 2000 or 3000 B. C.

Inside the cinerary urns were also found foods—wheat, beans, etc.—for the journey in the next world, as well as small objects and ornaments which had been very dear to the departed in their lifetime.

Doubtless the Bronze Age dwellers in Malta had heard the tradition that the tall stones standing, abandoned, deserted, and overgrown with weeds, had once been a sacred place, while in any case such high walls as were still standing formed a good shelter for their funeral fires. Hence the Bronze Age cemetery on this spot.

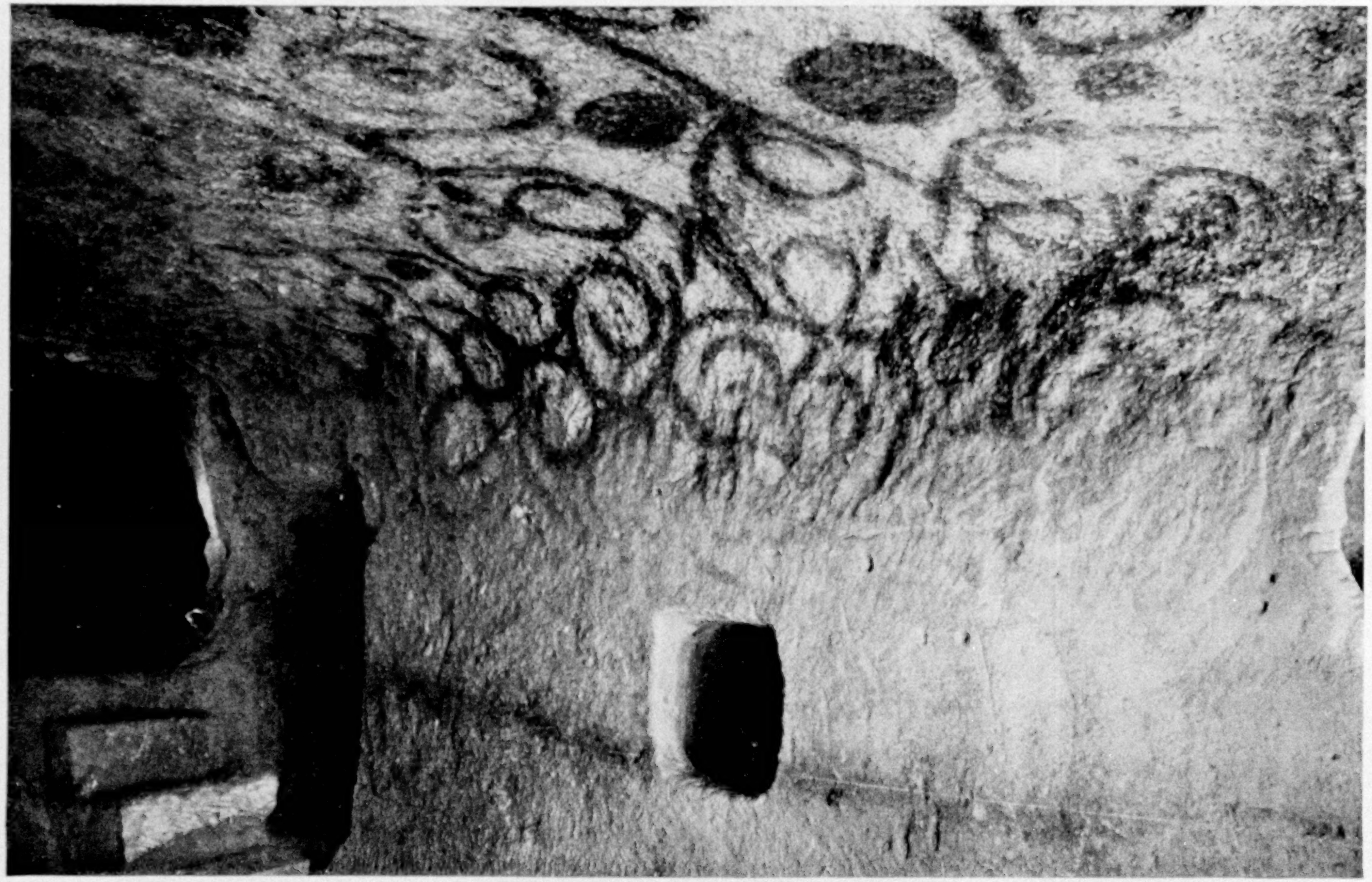
The Bronze Age layer was strongly marked with charcoal and ashes. Below this came several feet of fine sand, containing no stones or broken fragments of rock and no traces of any Bronze Age pottery or metal, clearly showing that this layer had been deposited by centuries of wind and rain, untouched by the hand of man.

All these layers were removed by the excavators with careful and reverent hands, as was due those far-off and forgotten worshipers of the Unknown God. Finally the floor of the temple was reached and cleared as perfectly as possible.

A TOUR OF THE TEMPLE

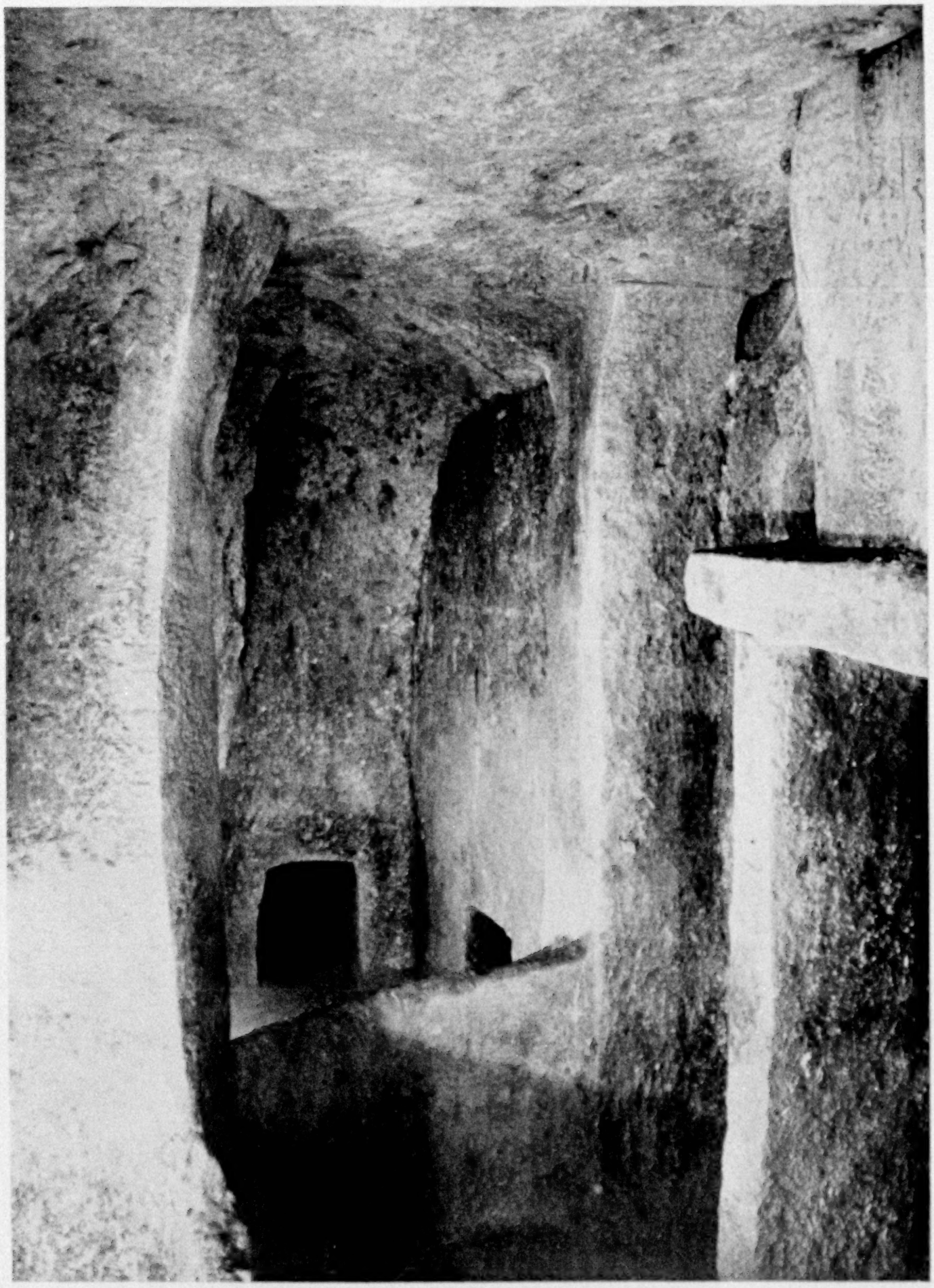
The length of the buildings from end to end is about 50 yards, while the level of the temple floor is about 7 feet below that of the field.

A VIEW OF THE MAIN HALL AND THE HOLY OF HOLIES FROM THE ORACLE ROOM OF THE HAL SAFLIENI TEMPLE (SEE PAGE 465)



THE CEILING PAINTING IN THE ORACLE ROOM IS THE FINEST TO BE FOUND IN THE HAL SAFLIENI UNDERGROUND GALLERIES

A word spoken in this room is magnified a hundredfold and is audible throughout the entire structure. The effect upon the credulous can be imagined when the oracle spoke and the words came thundering forth through the dark and mysterious place with terrifying impressiveness (see text, page 465).



LOWEST DUNGEONS OF THE HAL SAFLIENI RUINS

This innermost room of the subterranean galleries has four openings leading to small caves, where the temple's treasures may have been secreted (see text, page 466).

Let us make a tour through the temple, following the rough plan reproduced on this page.

We stand first on a semicircular stone, A in the plan, in which are drilled two holes connected at the lower ends. This is the ordinary tie-hole of Stone Age times and may have been used to tether sacrificial animals outside the temple. On each side can be traced large horizontal blocks of stone extending in a semicircular direction, doubtless the fore-court, or public place in which the people assembled before divine service.

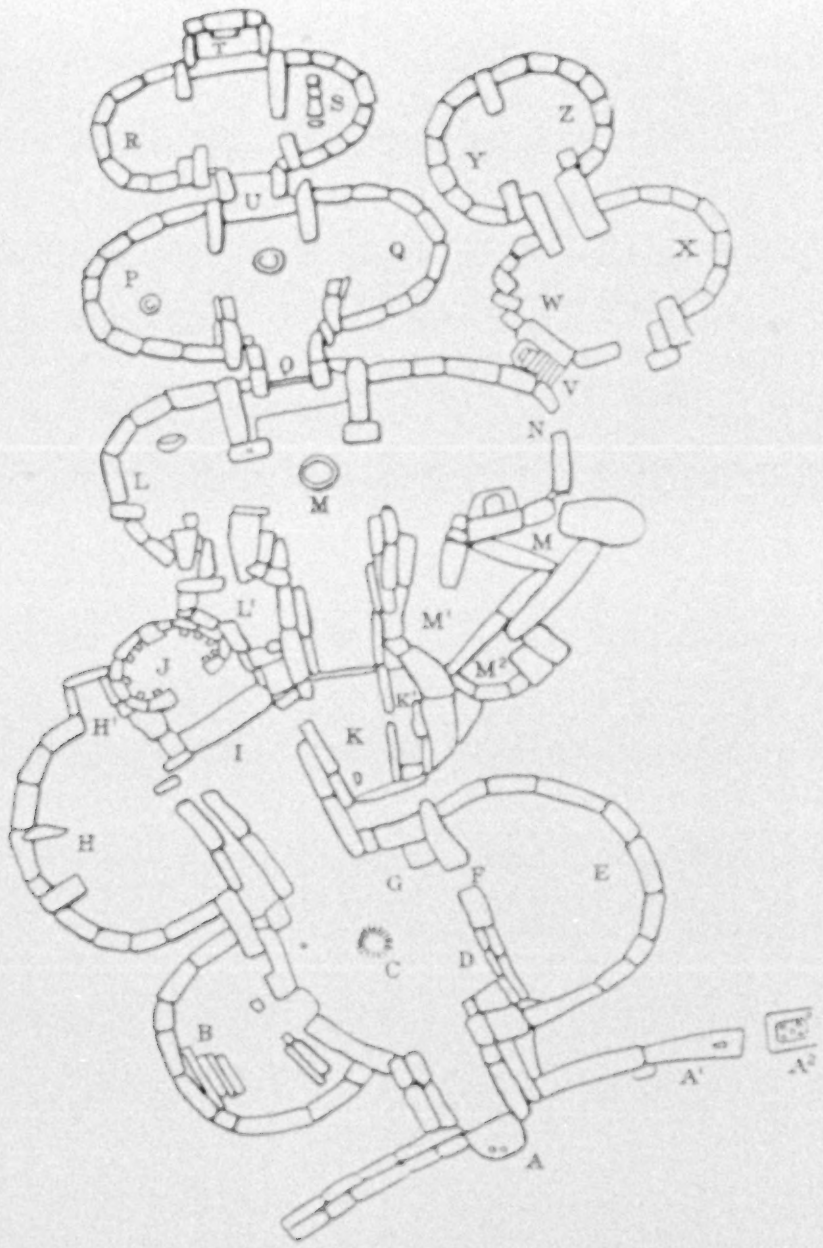
These large blocks apparently served as foot-stones to support large upright masses of masonry forming the outer wall of the temple. One of the blocks has a conical hole in it, besides several small circles engraved on it (A^1), all doubtless having some religious significance or used in the public worship or sacrifice. A few yards farther on is a stone (A^2), about two yards square, in which are five holes, some of oval shape and some round.

For what purpose this stone was used is not known. Possibly it was employed in the ceremony of ablution, as a somewhat similar contrivance was found in the Stone Age temple a mile away, at Corradino, shown on page 476. It has been suggested that this was the altar of sacrifice, and that the holes were to catch the blood of the victim. This is possible, but the sacrificial victim must have been killed first, as no tie-holes exist in these stones.

After the temple had fallen out of use prehistoric boys may have found that this formed an excellent bagatelle board, and by using rounded stones and possibly numbering the holes quite a good game could be played. A quantity of round stone balls was found on this site.

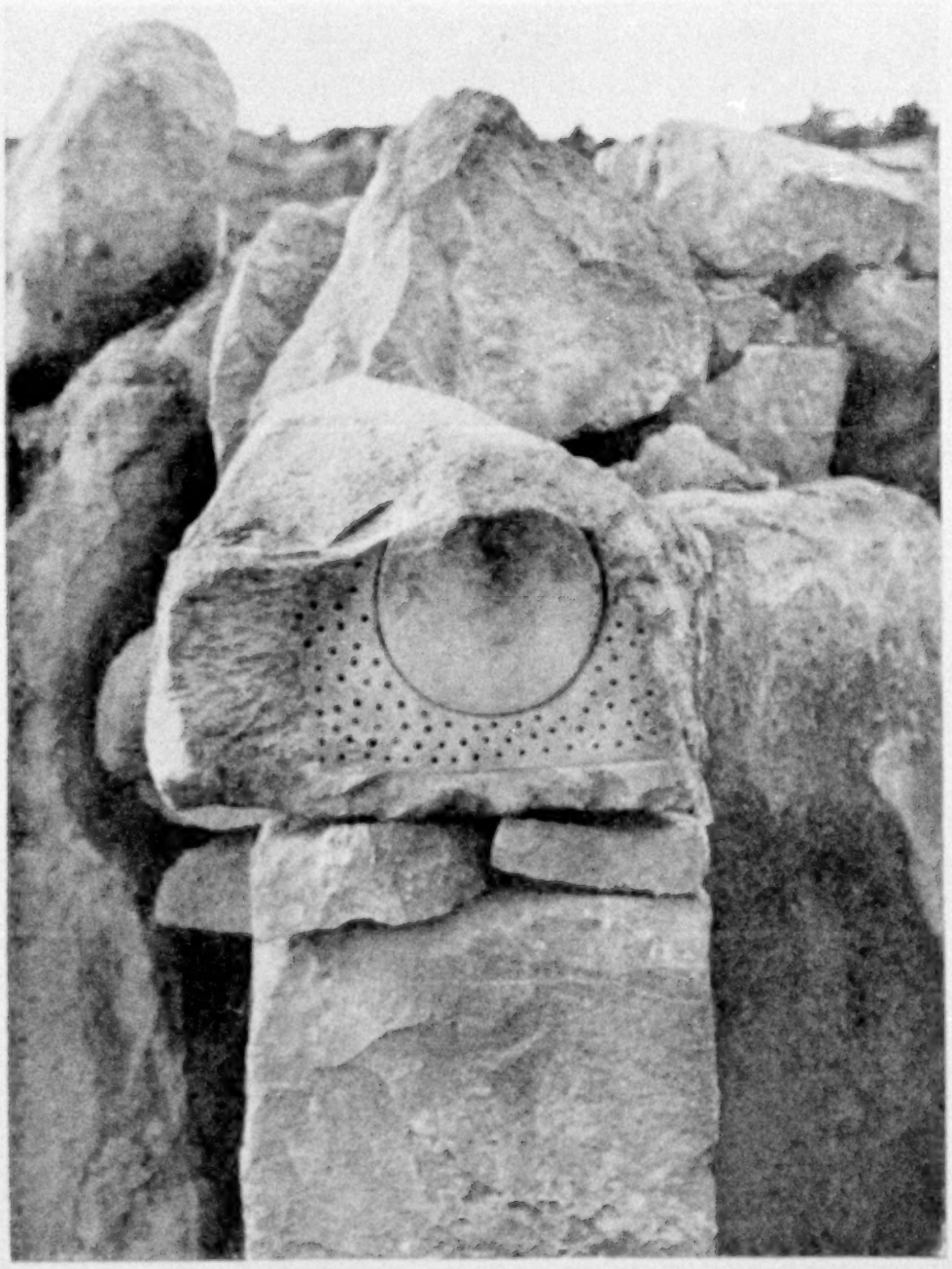
Returning to position 1 on the plan, we enter the passage A C and arrive in the building marked B E. Facing to the right, there is a beautiful carved dado round the room. In the center is the broken lower portion of a huge female figure, of which only the feet, fat calves, and fluted skirt now remain. When complete the figure was probably seven feet high. It stands on a slab of stone ornamented with egg-shaped symbols and would lead to the inference that it was the image of the Goddess of Life and Fertility. Carefully placed near her feet was found a sacred cone, possibly representing the male element.

Standing in position C of the plan, which is a spot worn away by innumer-



A SKETCH SHOWING THE ARRANGEMENT OF THE CHAMBERS OF THE STONE AGE TEMPLE OF TARXIEN

These ruins have been unearthed by a band of students working under the direction of Prof. T. Zammit, C. M. G. The work proceeded throughout the stressful period of the World War, despite limited government appropriations.



A MYSTIC STONE PILLAR MARKING THE BEGINNING OF THE INNER SANCTUARY OF THE TEMPLE AT TARXIEN

On top of the pillar is a second stone on which is carved a circle surrounded by pit-marks. Some students surmise that the circle represents the sun and the pit-marks the stars (see text below).

able fires, and turning our back on the goddess, we see beautifully carved altar tables and an altar, in front of which is a small font decorated with pit-markings, an ornamentation noticed in other prehistoric temples.

Apparently this font had been painted red with ocher, from which it might be inferred that the ceremony of sprinkling blood for cleansing from evil was carried out even in those far-off days.

Behind these pillars is a small side chapel very beautifully decorated. One slab contains a frieze of eleven goats, while another has four goats, a fat pig, and a horned ram or buck.

Looking again from position C to G in the plan, we see a large carved stone table or chest in front of an altar or oracle place of the dolmen type so noticeable in all neolithic temples. The large altar stone is hollow, with a detachable semicircular fitting.

Inside was found a very fine curved flint knife, as well as fragments of beautifully polished Stone Age pottery. It might be observed here that possibly all votive vessels were broken after the sacrifice, to denote the completion of the ceremony, as practically none were found complete.

Proceeding through position C to I, we reach the principal altar of the temple. The curved façade of the floor of the "chancel" cannot but arouse admiration for the wonderful skill of those ancient workers, whose only tool was a flint. On the left corner of the carved stone can be seen a round tie-hole. The stone a little to its right and standing back two yards from it marks the beginning of the inner sanctuary, which consists of a semicircular building with five stone seats on each side of the altar. These possibly were either for images or for the officiating priests.

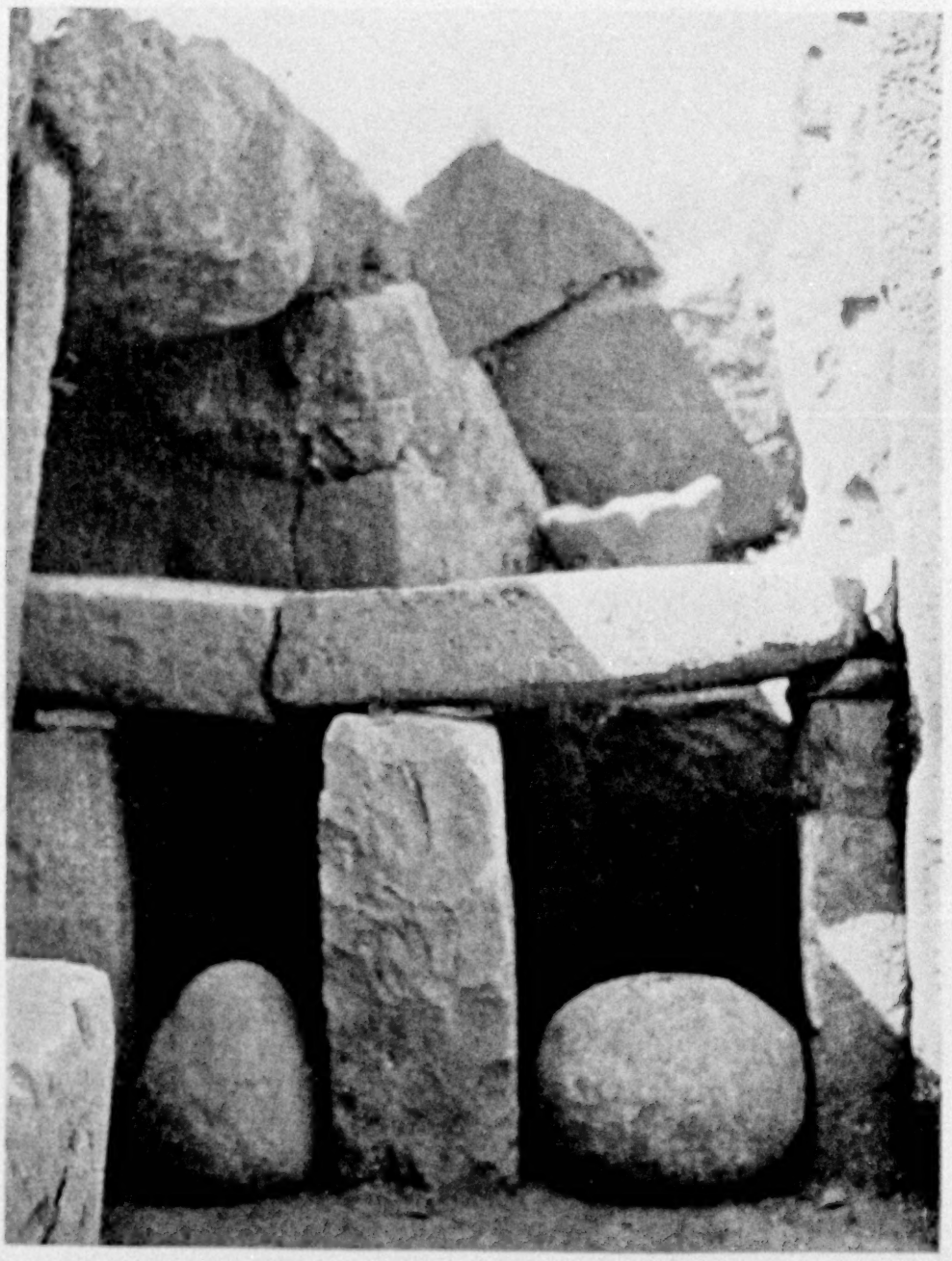
On top of the stone at the left entrance to the inner sanctuary is another lying horizontally with a square end on which is carved a circle surrounded by pit-marks (see illustration on this page).

Without doubt this had some reference to their religious beliefs, but the stone on the opposite side is missing.

It has been suggested that the circle represented the sun and the pit-marks the stars, while others suggest a phallic solution. A stone was found carved with two phallic pillars standing on a base decorated with pit-marks. When the two designs are considered together, possibly a key to their ceremonies and beliefs may be found.

The corbeling, very noticeable in the right wall of the inner sanctuary, would show that this building was domed over.

Entering room H, which is very badly damaged, we see a tiny dolmen-shaped altar marked H^1 in the plan. The top of the altar table has a hole in it, fitted with a plug. Through this a memento, such as a small bone for each sacrifice, was possibly placed for temporary custody.



AN ALTAR IN THE TARXIEN TEMPLE, BENEATH WHICH APPEAR THE FAMILIAR PHALLIC SYMBOLS OF THE CONE AND THE BALL (SEE TEXT BELOW).

Returning to position I, we enter a new and earlier temple, in which the decoration is less ornate. We first notice a small side chapel, K^1 in the plan. Entrance is gained through the doorway, which is so low that one is required to bow in passing.

Immediately opposite is a sacred stone of worship, broader at the top than at the bottom. Its significance is not known, but stones of this design appear in the "Holy of Holies" at other temples. On the left of this stone is a corner seat for the priest, while on the right is the altar (see illustration above), with its familiar phallic symbols of the cone and the ball.

In the passage leading from position K to O, the investigator sees holes in the masonry on each side, indicating that barriers and curtains were hung here. A straight view can be obtained down the aisle leading to the Holy of Holies, where the sacred stone faces the visitor. In the center is a much-burnt stone fireplace full of ash, M in the plan.

Looking toward the northern end of this oval-shaped building, we see at the far end an entrance, afterward closed by a huge block of stone.

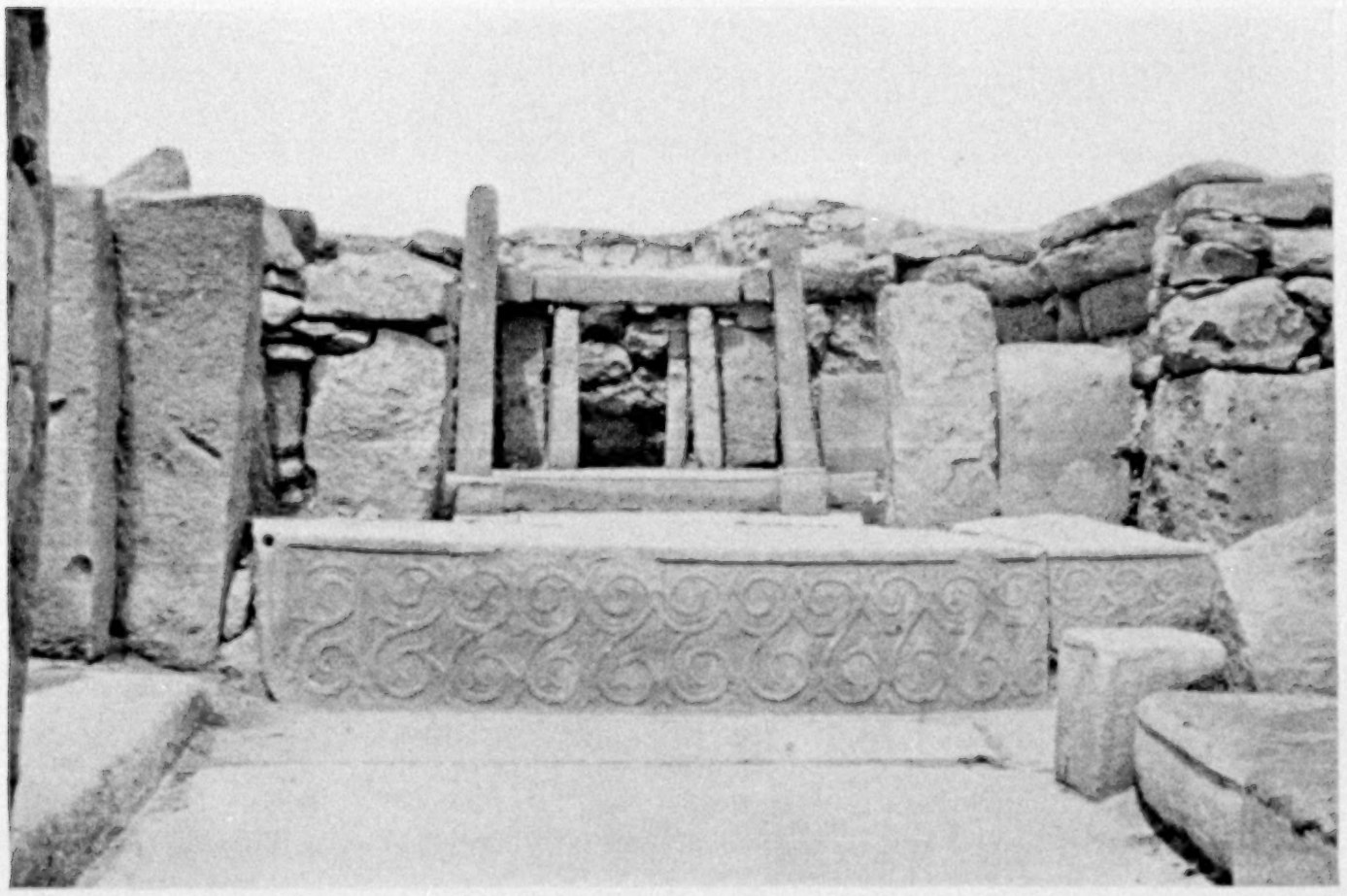
Near the Sacred Stone is a round stone

A CORNER OF THE TARXIEN STONE AGE TEMPLE, SHOWING THE CARVED ALTARS, TWO SACRED CONES, AND A TOMB: MALTA

The dark patch on the right of the photograph marks the site of funeral pyres. Tarxien is a continuation of the village of Casal Paula, where the Hypogeum of Hal Saflieni was situated (see page 459).

A CURIOUS STONE WHICH MAY HAVE BEEN USED BY THE ANCIENT INHABITANTS OF MALTA IN THE CEREMONY OF ABLUTION

A quantity of stone balls was found near this slab, which suggest the possibility that at a later period it may have been used for games (see text, page 473).



THE MAIN ALTAR OF THE TEMPLE AT TARXIEN: MALTA

The graceful carving awakens admiration for the prehistoric stone-cutters, whose only implements were sharpened flints (see page 474).

plug. Here, it may be imagined, the sacrificial ox was brought in and tethered. Armed with a heavy stone axe, the priest felled the animal, completing the sacrifice with a sharp flint or obsidian knife. A huge basin or laver was used in the ceremony of purification.

The sacrifice was cut up on a large stone between the laver and the fireplace. This stone has a deep, round hole into which the blood of the sacrifice drained. The portions to become the burnt sacrifice were there cut off and placed on the sacred hearth. A large stone table on the right contained no drainage hole and doubtless was the place where the burnt offerings and oblations were dedicated to the gods.

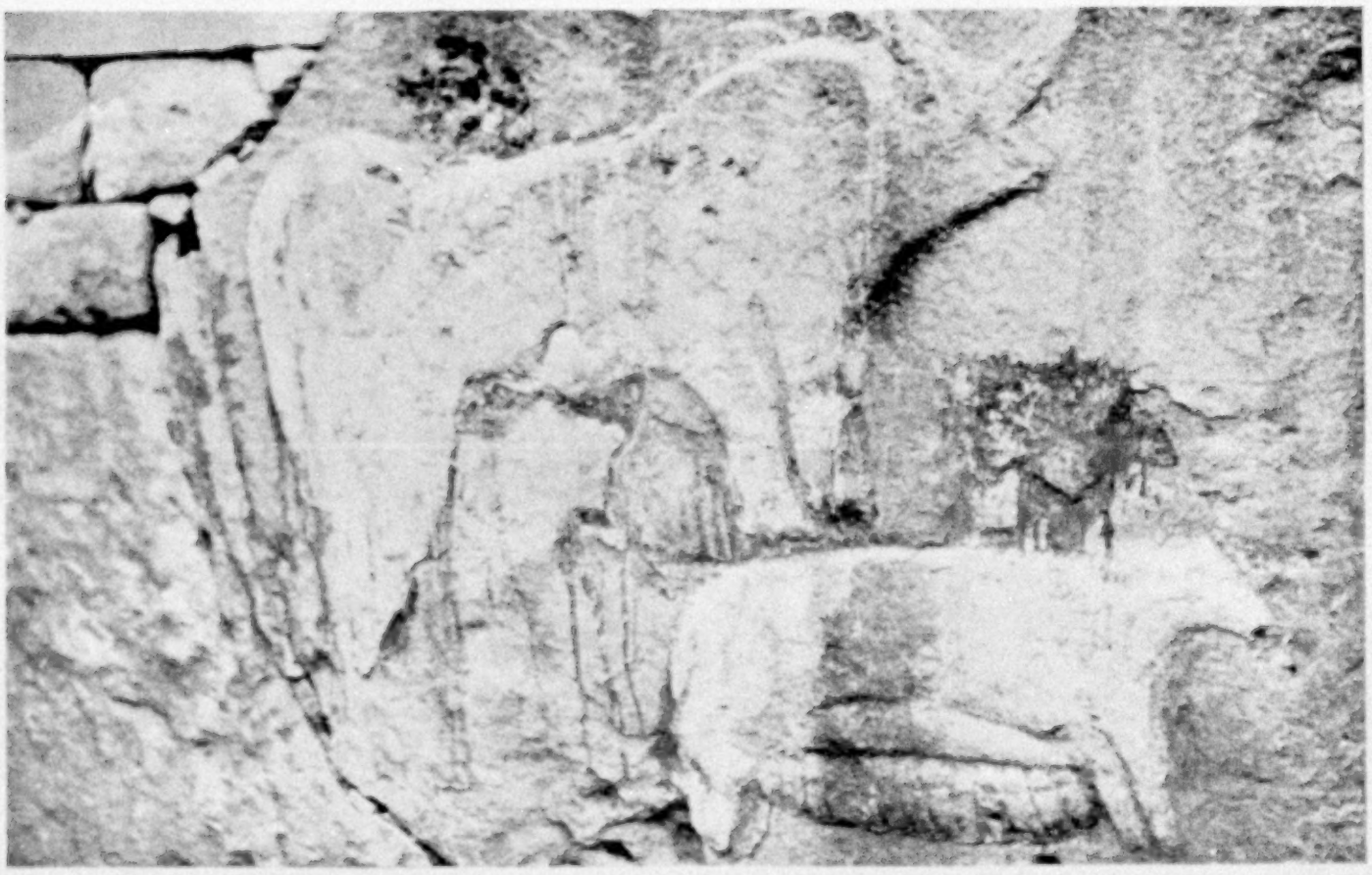
Opposite this table of oblation is a passage leading to a small side chapel, marked M^1. This contains a small altar, while on the walls are carved in bold relief three animals—a bull, a sow, and a second bull facing the first (see illustration on page 478). These carvings are among the earliest known of this type.

Two large bull's horns were found carefully hidden under the entrance to this sanctuary. It appears, therefore, that the worship of the sacred bull, so widely spread and still existing, was carried on in Malta just as the Minotaur was worshiped in Crete.

Two doorways on the ground level, about two feet square, lead from two small rooms M^2 and M^3, where possibly goats or lambs were kept ready for sacrifice.

Returning to room L, M, we mount a long horizontal slab just beyond the round hearth. Here we are much struck with a beautifully carved barrier about a yard high. This evidently marked the part of the temple dedicated to the uses of the priests.

Between the spirals are carved two cones. Mounting over this and again noting the various curtain and door slingholes in the side walls of the passage, we come to another oval building, P Q in the plan. This has similar features to the previous room, but is smaller and entirely without carved work except a stone screen on each side, finely decorated.



A BULL AND A SOW CARVED IN BOLD RELIEF ON THE WALL OF ONE OF THE CHAMBERS IN THE TEMPLE OF TARXIEN (SEE PAGE 477)

These are among the earliest carvings of this type known. Near by, carefully hidden under the entrance to the sanctuary, were found two large bull's horns, suggesting that this animal was worshiped in Malta as the Minotaur was worshiped in Crete (see "The Sea Kings of Crete," by James Baikie, in THE GEOGRAPHIC for January, 1912).

Between the screens and the entrance rose two huge pillars, now broken off at ground level. In the center of the room is a sacred hearth, while apse P contains a well-preserved altar and a font, the latter being pit-marked and still bearing traces of red ocher. In a tall slab opposite the carved screen is a black spot on the edge near the floor. When excavated the bottom of this pillar was found to be adorned with five pebbles let into the stone, three in the top row and two below at the ends. No convincing explanation has been suggested for these stones.

We now come to the last and final room, R S T U. Here no stone barrier bars the way, but the holes for the screens can still be seen.

The last apse is the smallest of all, and the inward inclination of the stones indicates that the rooms were domed over.

With feelings of awe we retrace our steps down the main aisle, and, having arrived at Room L-N, we turn to the left and find an exit marked N in the plan. On each side is a sort of pulpit on which the priest might have stood to address the worshipers.

Possibly an image or round stone ball, of which several two feet in diameter were found, was placed on this pedestal.

The exit leads to a much more roughly built series of rooms, marked W-X and Y-Z. Outside exit N and on the left is a flight of steps, V.

SECRETS OF THE PAST AWAIT DISCOVERY

Beyond these apses sufficient soil has been removed to show that the prehistoric buildings extended for a considerable distance into the next field, and that the walls are those of square, and not oval, buildings. Here it seems likely that the laity lived, and it is hoped that when funds are once more available further research may be carried out to delve into the secrets of the long-forgotten past. Here we may find one more clue in our attempt to solve the question whence man came, in the hope that we may find whither man goeth.

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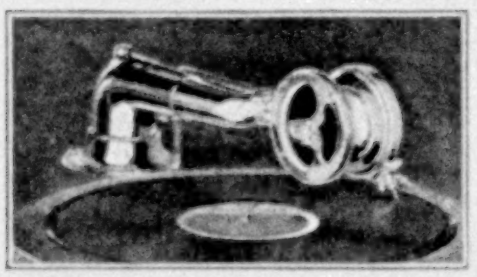

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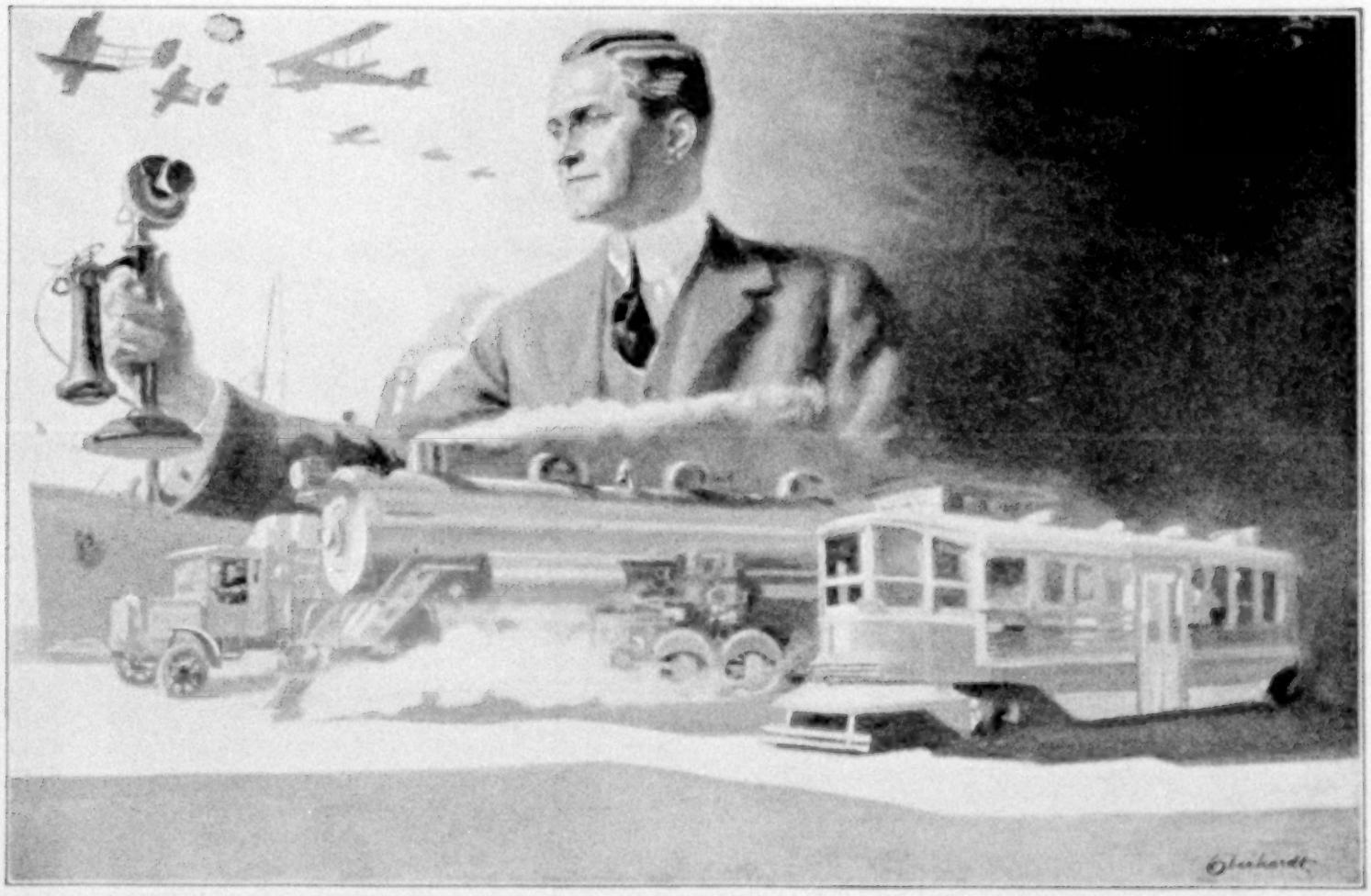

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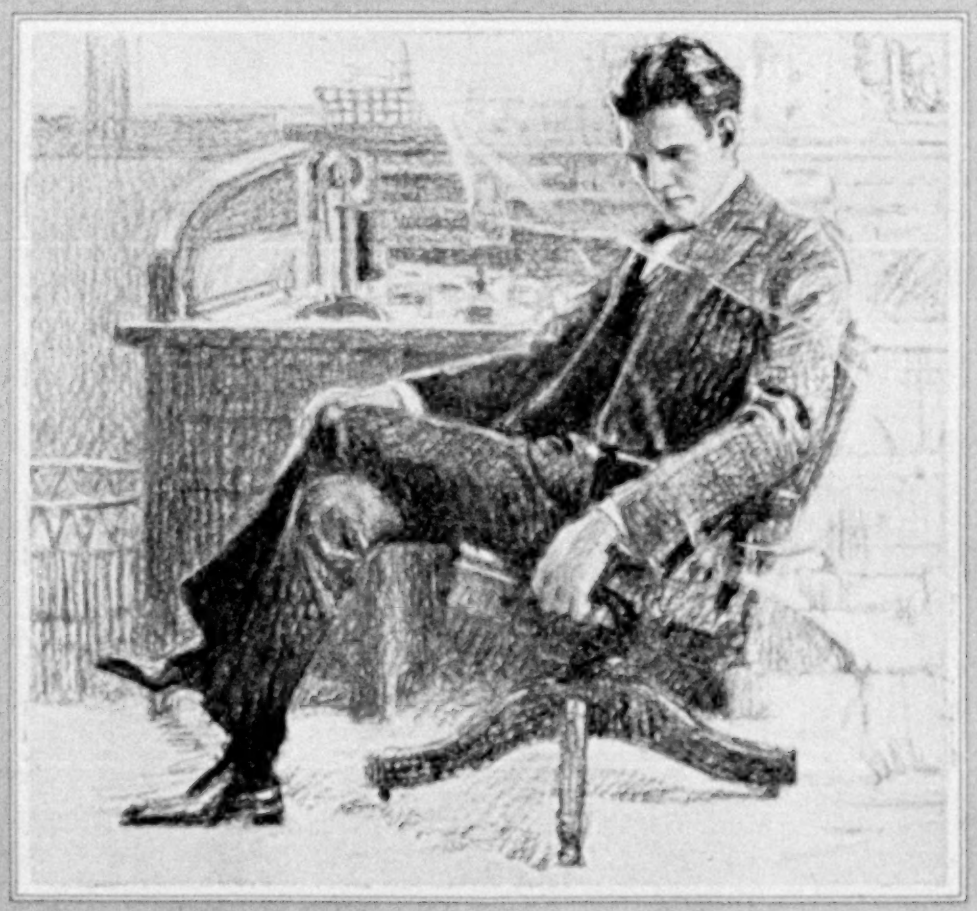

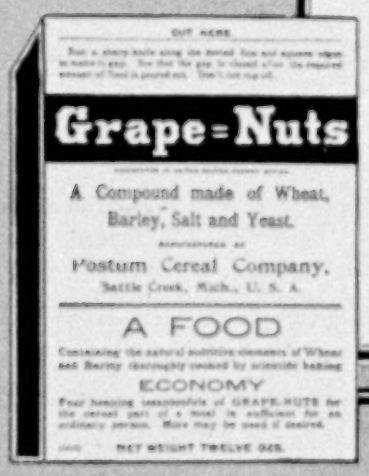

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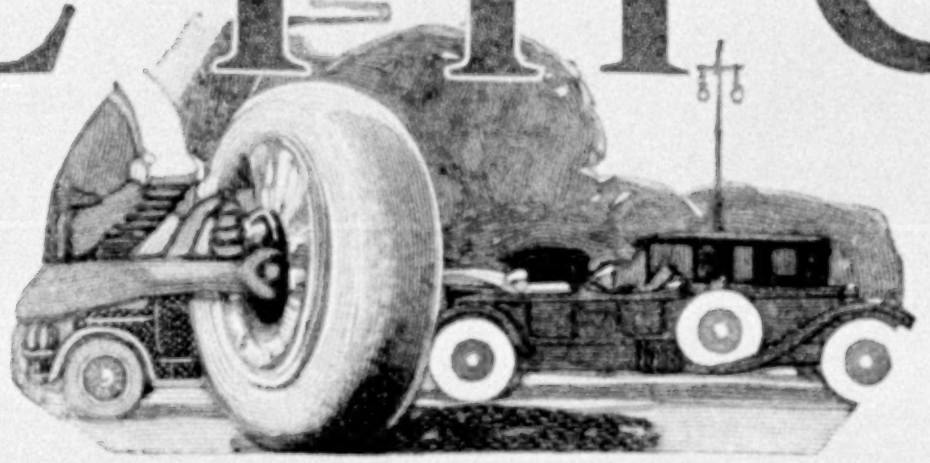

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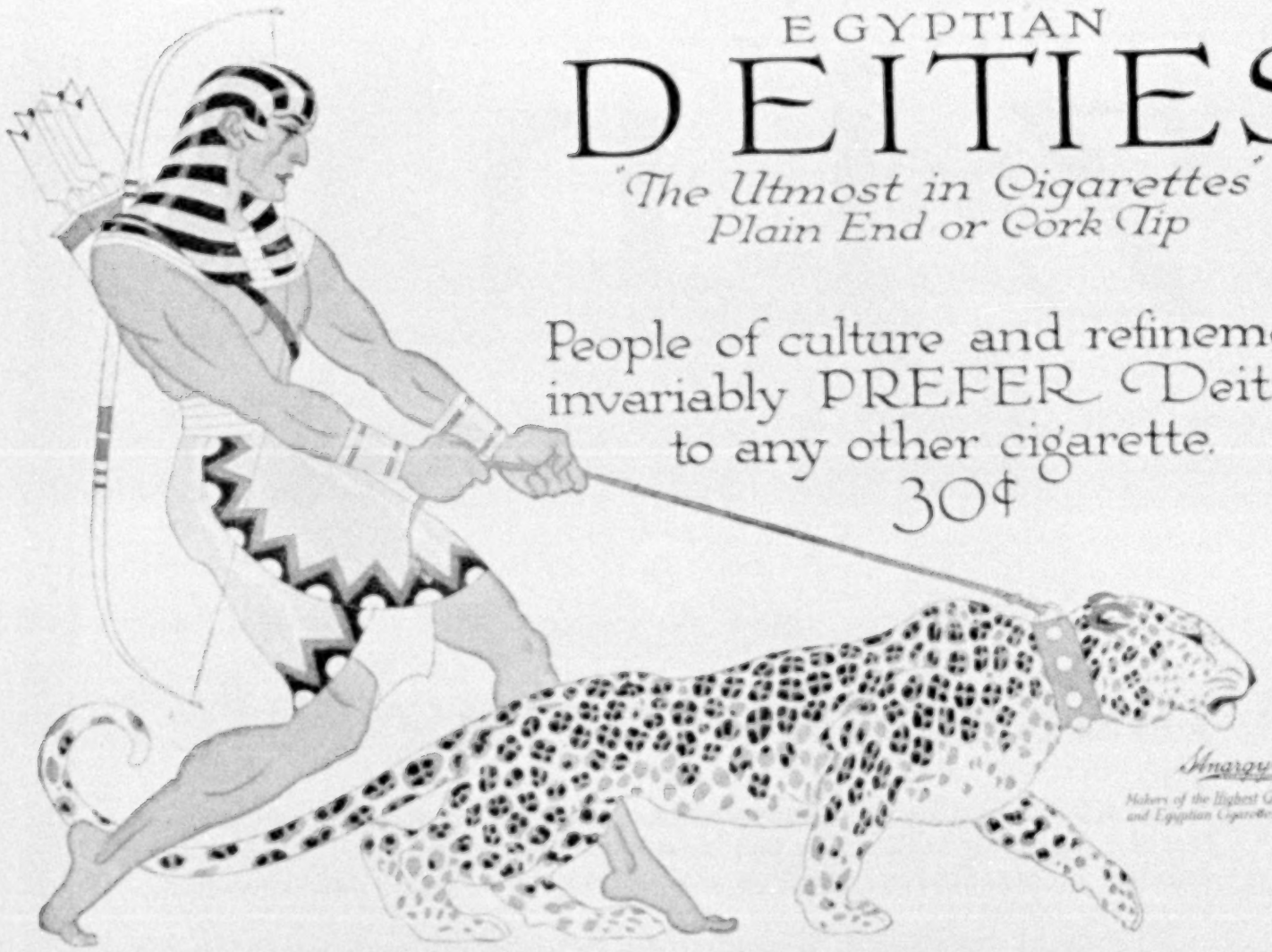

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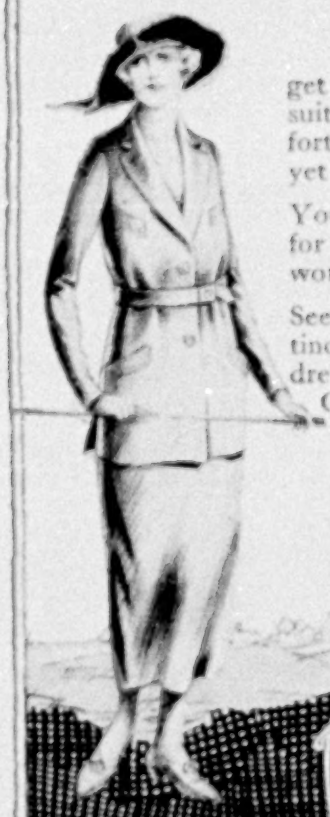

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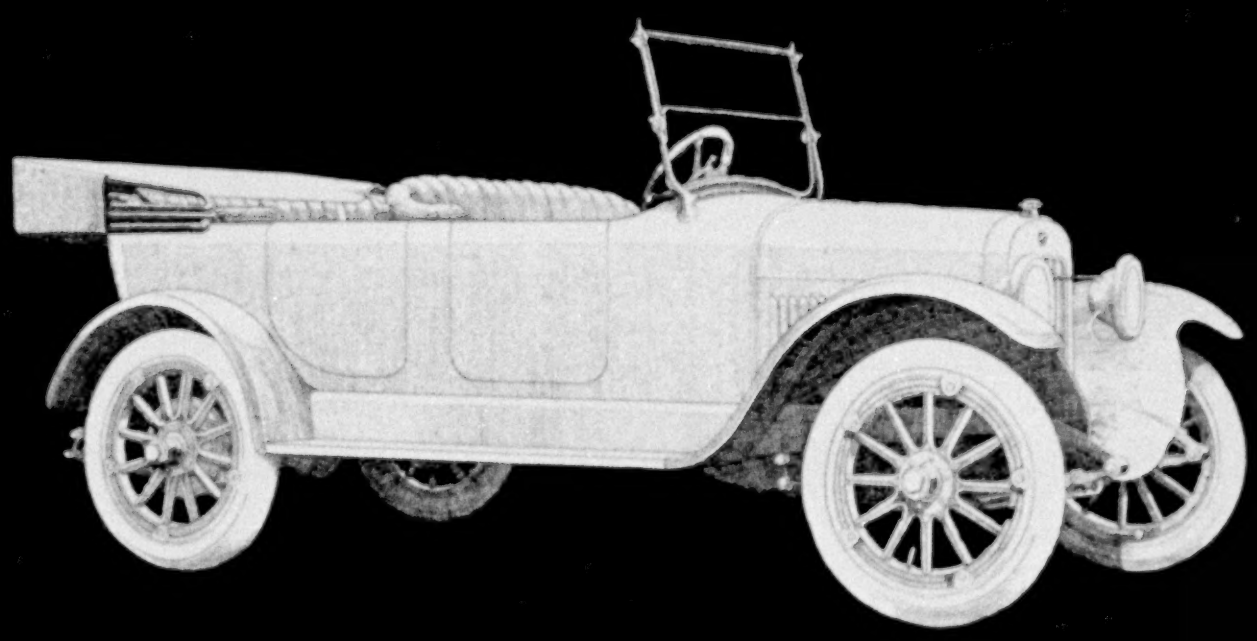

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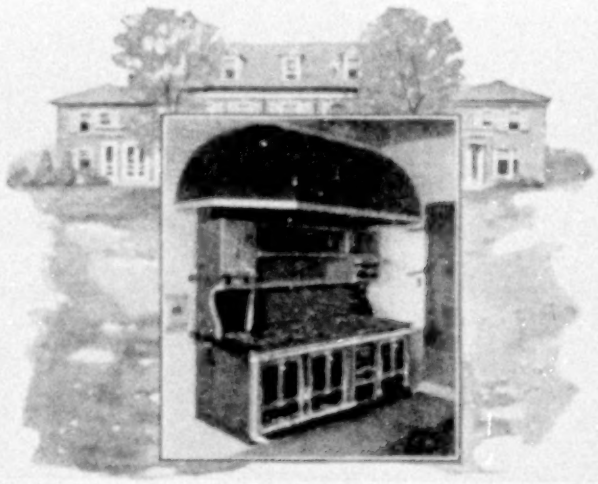

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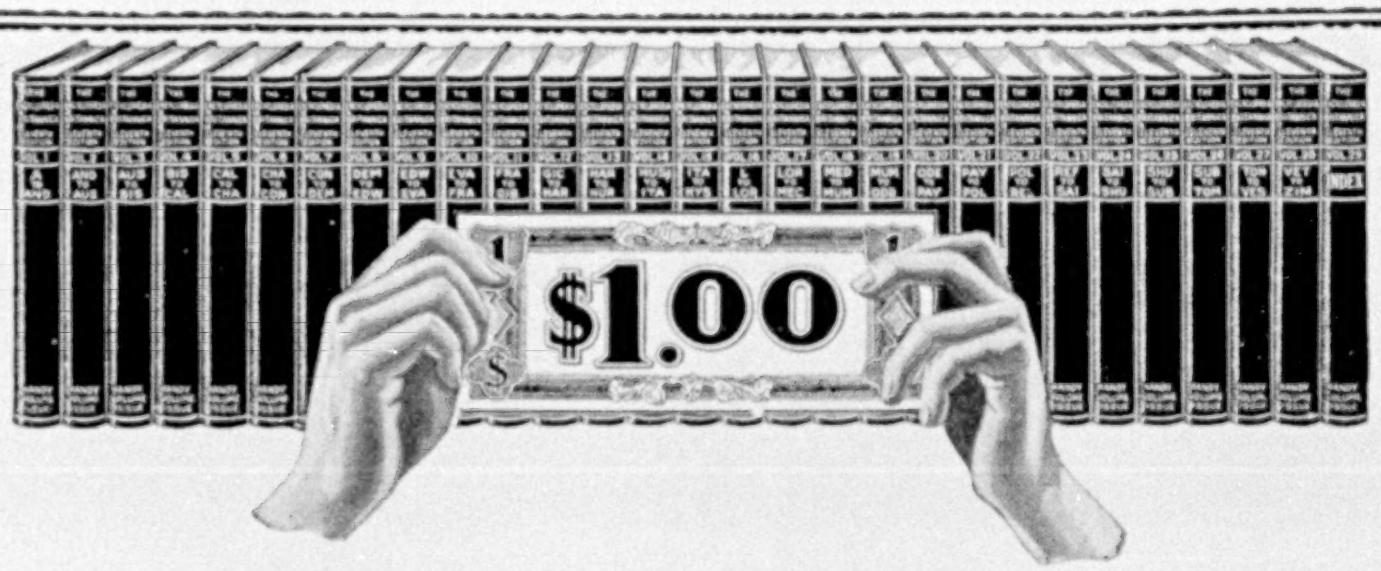

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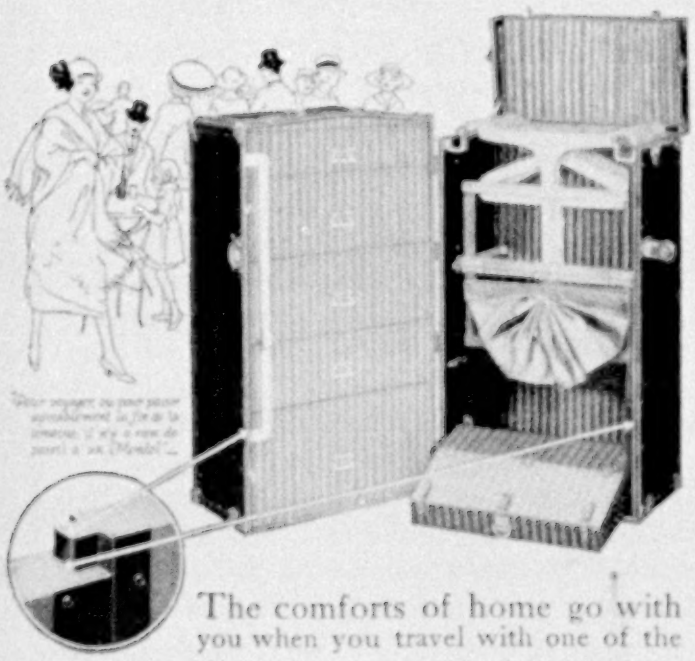

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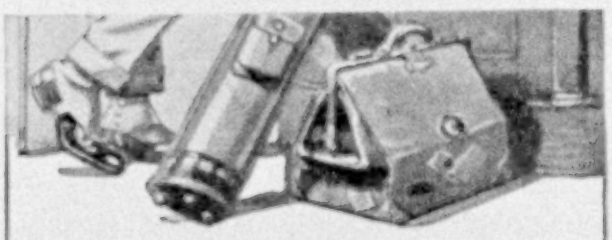

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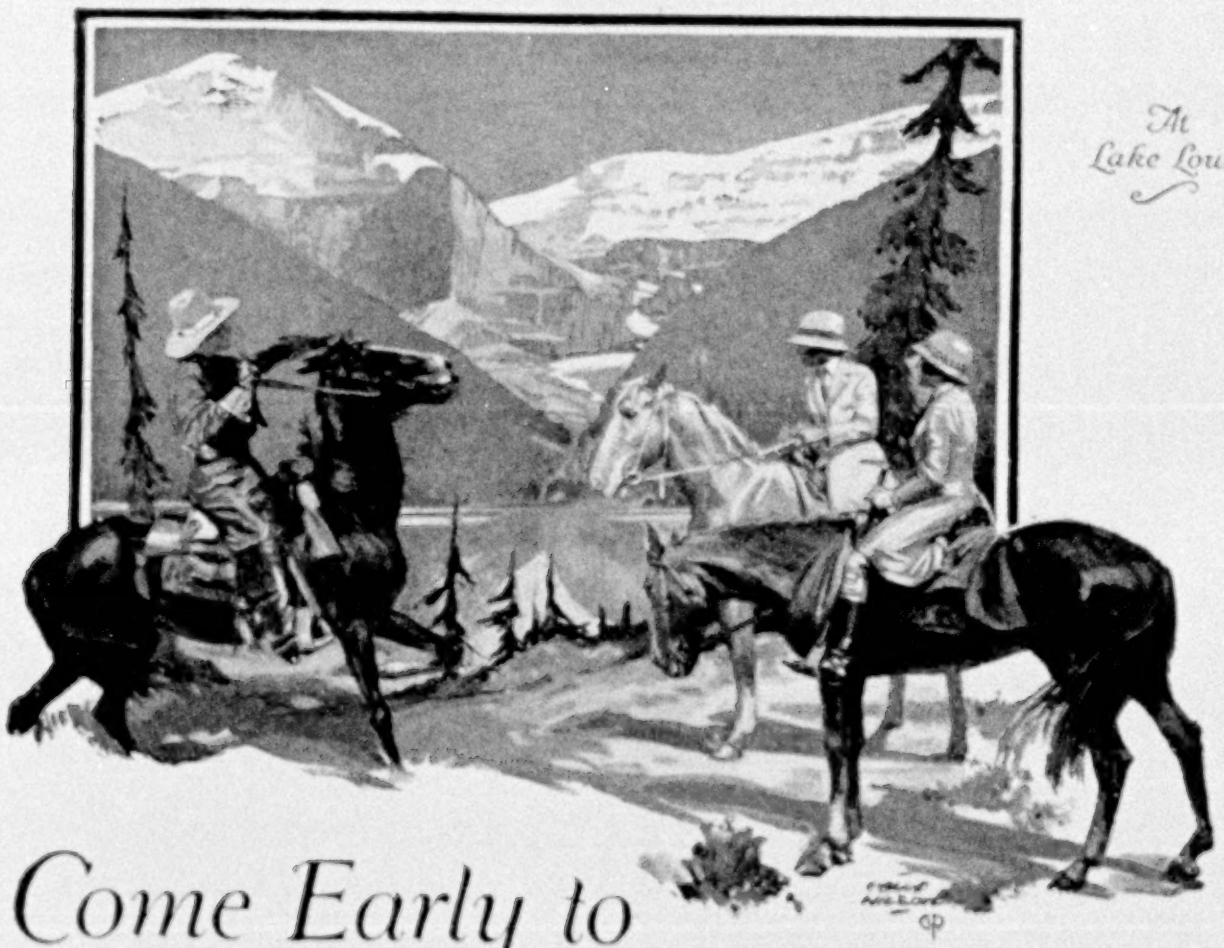

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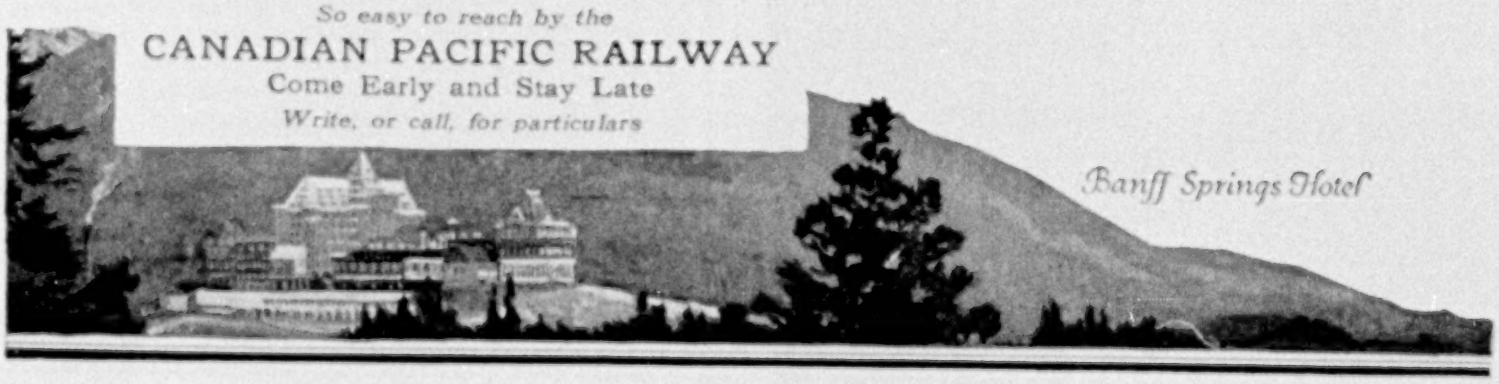

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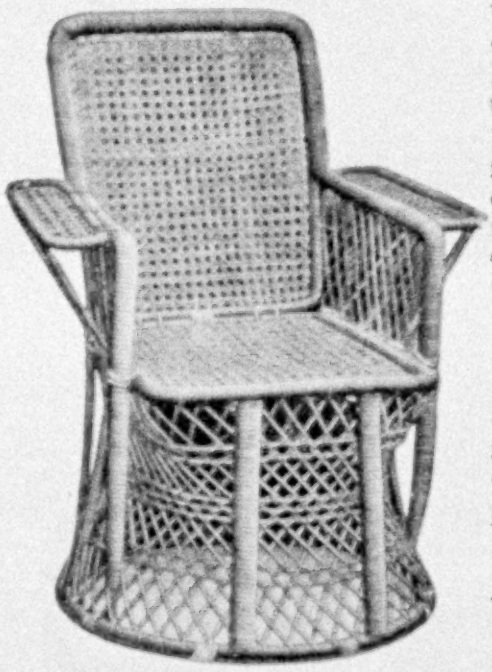

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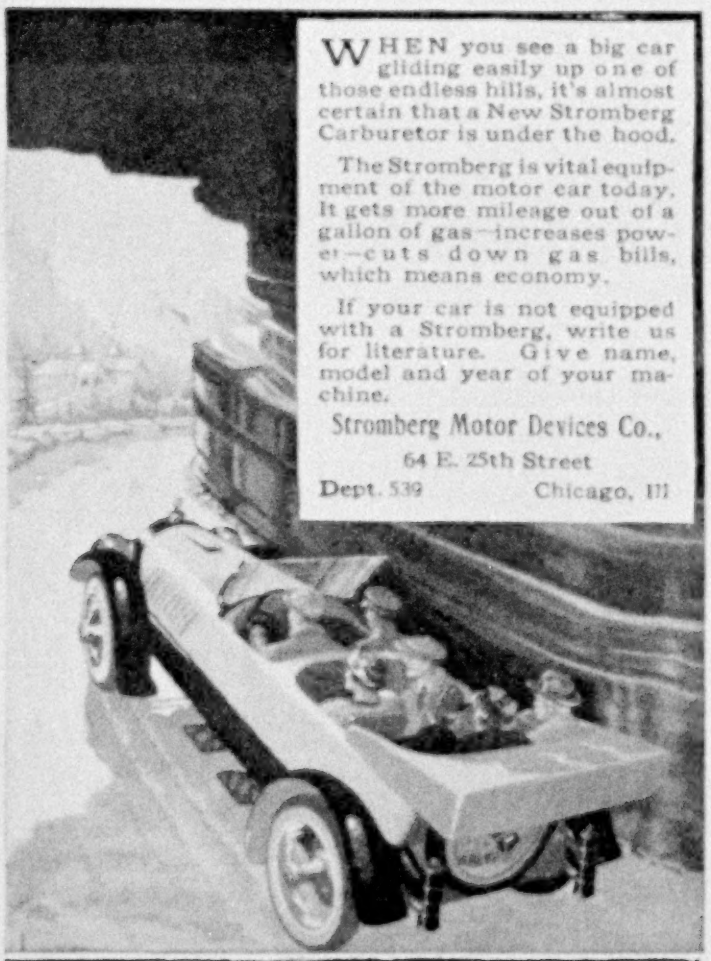

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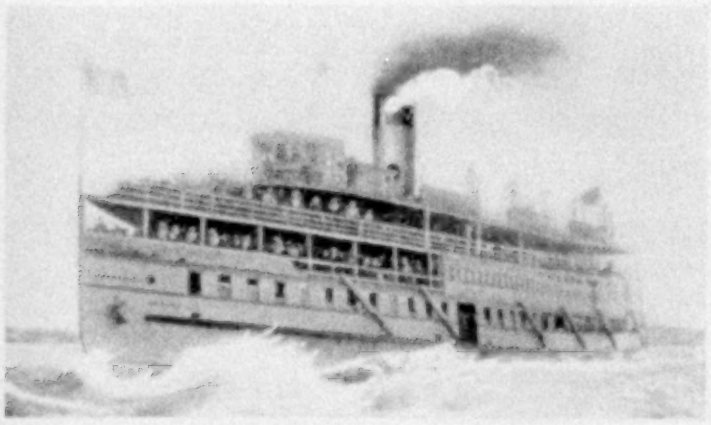

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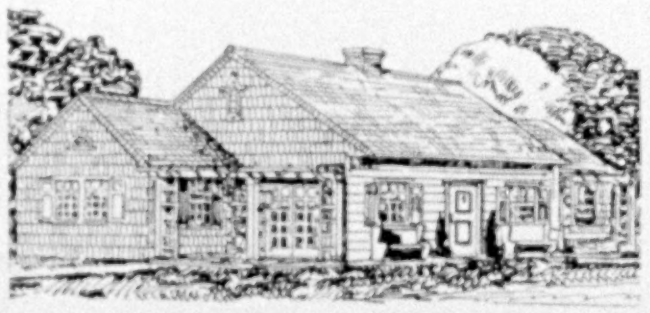

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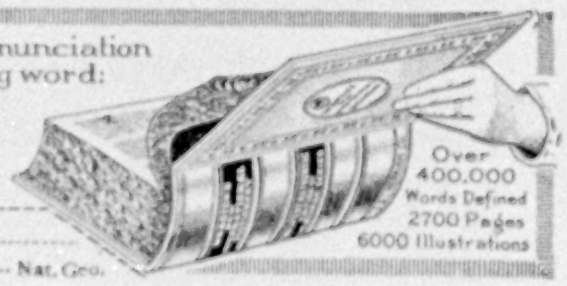

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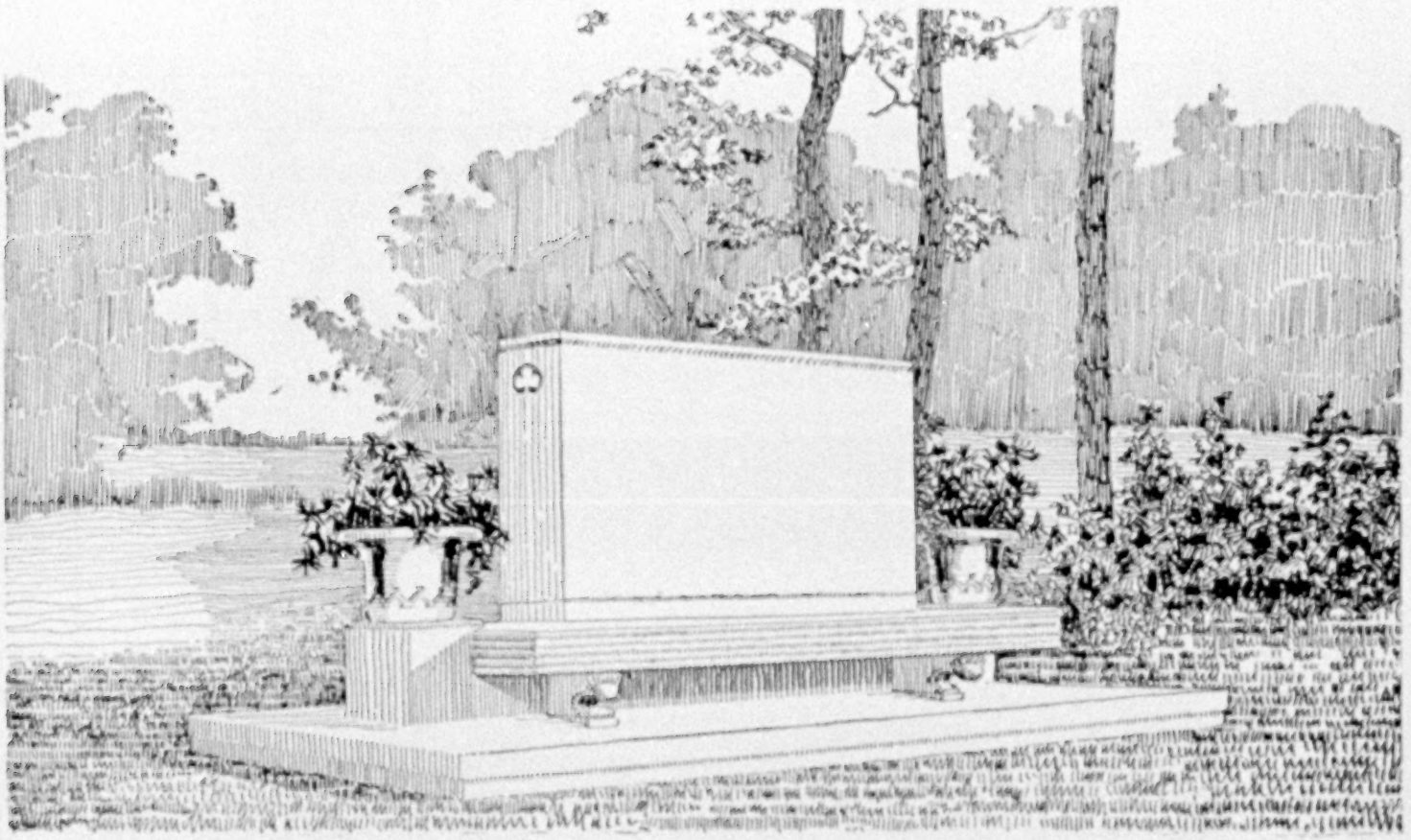

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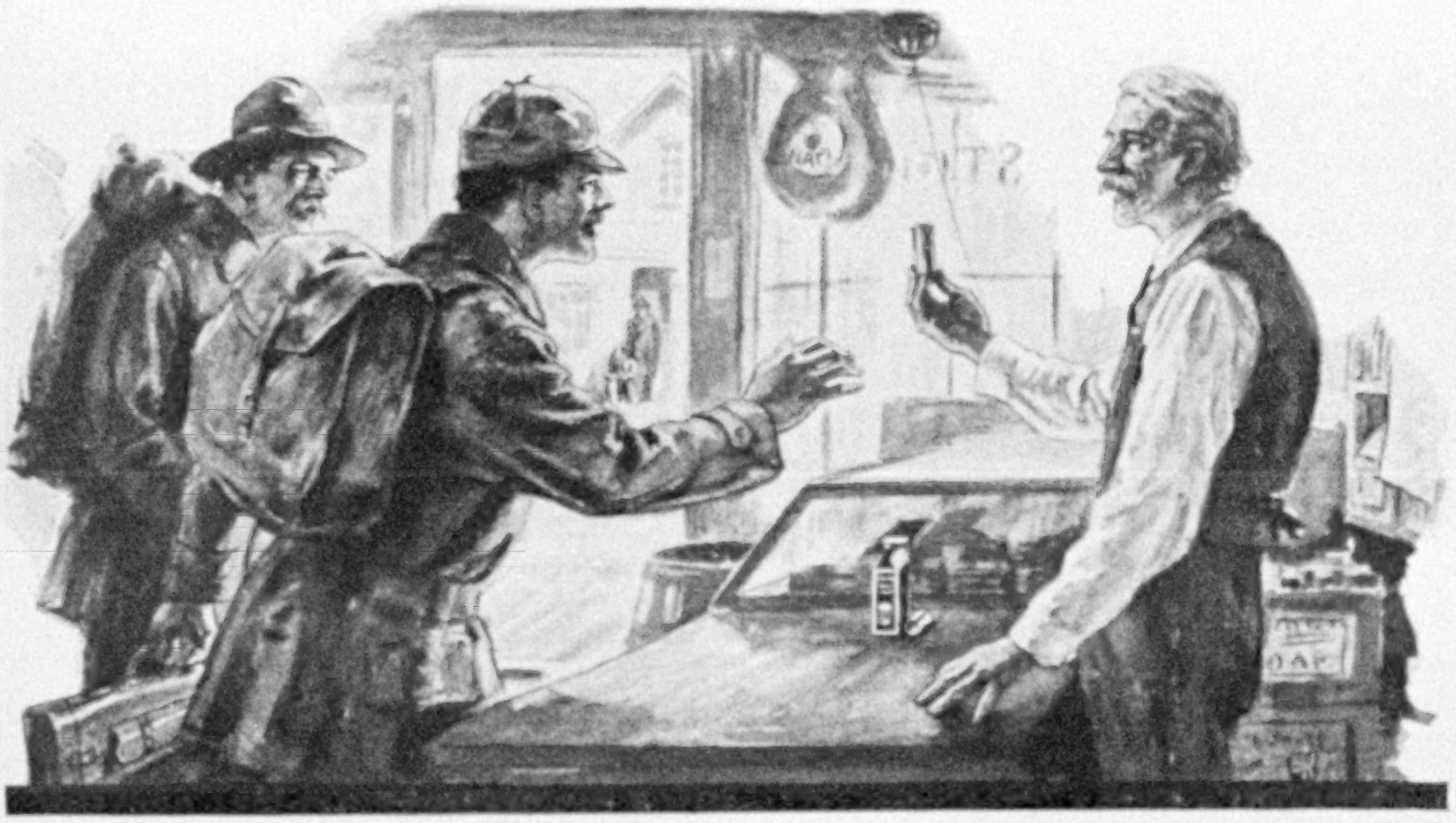

COLGATE'S

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